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Ash-content of Coke

Foundrymen in Europe are disturbed on account of the increasing quantity of ash in consignments of coke they receive, yet they are very much better placed than their *confrères* in South Africa and especially India, where the percentage may reach 35 per cent. If viewed from the volume aspect, the figures quoted for the percentages can be doubled. In this country, hard-headed foundry owners have regarded the increase in coke ash as simply the deterioration of their major fuel—*i.e.*, that there is less carbon available to melt the charge—but metallurgically it is the carbon pick-up which may cause the major waste. Mr. A. G. L. Lewis, in a Paper to the South African branch of the Institute of British Foundrymen, which is printed elsewhere in this issue, shows that efficiency for the recarburizing of steel varied from 70 per cent. when using pure graphite to 60 per cent. using 5-per-cent. ash Durham coke and 40 per cent. when using 16-per-cent. ash Natal coke.

In the cupola much the same thing occurs, for in a charge carrying no steel but cokes of 5, 10, 15, and 20 per cent. ash, the carbons in the resulting irons were 3.7, 3.5, 3.4, and 3.2 per cent., respectively. When steel is incorporated, these carbon contents progressively decrease, until with 75 per cent. steel, the four figures then read 3.1, 2.6, 2.4, and 2.2 per cent. Naturally, these percentages will vary from plant to plant, but the general trend will still be there. The effect of low carbon in cast iron is to decrease fluidity and involve much heavier risers. Here again, quoting Mr. Lewis' figures, a carbon content of 3.2 per cent. requires 10 per cent. by weight of feed metal; 3.0 per cent. demands 20 per cent., 2.6 per cent. needs 25 per cent., and 2.2 per cent. no less than 40 per cent. A private letter from Mr. P. A. Russell to one of our readers in South Africa contains a paragraph which is pertinent to this subject. It reads:—

> "This type of runner [Connor] has been used in alloy cast iron and is successful provided that the carbon is not too low."

The main object of these remarks is to impress upon foundrymen that increased ash in their coke supplies not only means a lowering of calorific efficiency, but can have a profound deleterious effect on the properties of the castings being made. It is this latter fact which needs to be impressed upon the coke makers. Obviously, by meticulous control of cupola practice much of the trouble can be overcome. However, so many of the smaller firms making castings have over the years developed a mix or-mixes which "suit their customers" that an unannounced deterioration in their raw materials may have very serious repercussions, as the size of the foundry is no guide to the engineering importance of the castings it supplies.

Association of Bronze and Brass Founders

London Area Meeting

The talk given by Mr. E. C. Mantle on "Pressure-tight Gunmetal Castings" at last week's informal meeting of the Association of Bronze and Brass Founders was very well received by the score or more of delegates present. It was clear that a number of founders had not realized the potentialities of using metal/mould reactions for this class of alloys, nor yet the superior castability of the 85/5/5/5 series over the high-tin bronzes. Mr. W. R. Marsland, president of the Association, said that savings accruing from the adoption by his firm of the principles laid down by Mr. Mantle had in themselves already more than outbalanced subscriptions for research for many years to come, and this was only one of many items from which benefits had been secured.

The rest of the agenda included general discussions of such matters as trends of metal prices; follow-up action to be taken on productivity; the availability, free of charge, of the film "Bronze Founding"; coke supplies; standardization of inspection procedures; recommendations with regard to B.S.1400 specifications generally and those for aluminium-bronze in particular; the colour code for ingots; and the necessity for statistics for the industry. All were enthusiastically followed up and an overall impression was received of worthwhile service being given to members.

Elimination of Obsolete Specifications

The technical committee of the Association of Bronze & Brass Founders, in conjunction with its work on the standardization of alloys, has advocated that when enquiries are received for non-standard specifications, or an out-of-date title is used, the customer's attention should be drawn to the current specification. To facilitate this a "sticker" label has been designed for attachment to the quotation form or drawing; it is hoped by this means to convey the information to the designer. These are printed in sheets of five and can be obtained from the secretaries at a nominal charge.

Forty Years Ago

In our issue of July, 1912, there was printed the annual report of what is now the Institute of British Foundrymen. It then had a total membership of 889. There was a profit on the year's working of £94—but these represented golden sovereigns! A paper on electric furnaces should interest historians—yet they must exercise care, for it was usual at this time for as much space to be devoted to patent specifications as to workable plant. Moreover it contains some misstatements. Amongst the business notes, it is stated that J. W. Jackman & Company Limited removed to their present address.

AFTER OPERATING in Smethwick for 40 years, the Idoson Motor Cylinder Company Limited moved to new premises on the Hainge Road industrial site, Tividale, on July 18, and is to reopen production there on August 5. Within the next month the firm's associate company, T. & J. Foundry, of Wolverhampton Road, Oldbury, is moving to the same site at Tividale. Much of the existing equipment will be moved, new equipment will be installed, and a modern layout achieved.

Designing a Foundry

Once again the fourth-year students of the Architectural Association School have been given the design of a foundry as a test. The last occasion was two years ago, when one of the designs evolved was illustrated in the JOURNAL.* On the present occasion, the students visited the works of J. & E. Hall, Limited, of Dartford, for a knowledge of the site conditions. Here, there seems to have been some misunderstanding at the briefing, for at least two groups of students (they work as quite small teams) have labelled their efforts as steel foundries, but have cupolas as the melting units. Many of the examples shown at the exhibition now being held at the school, 34, Bedford Square, London, W.C.1, show the pattern-stores within the foundry building. It is thought, however, that the fire-risk thus imposed might prejudice the passing of their designs by the local authorities. One group has shown real novelty by the creation of a figure-eight building—maybe as a result of impressions gained from the Dome of Discovery. There is a circular foundry in existence, but so far as is known, this is the first example of a figure-eight construction being put forward. Much original thought and painstaking work has been put in on the models, and the students are to be congratulated on their enterprise. The exhibition is open from 10 a.m. to 6 p.m. on weekdays until the end of this month.

* Neophyte Architects Design a Foundry, JOURNAL, July 13, 1950, p. 48, illustration, August 17, p. 190.

Australian Fellowship in Industrial Research

A fellowship worth £A1,000 is offered to students in any branch of industrial research by the British Memorial Fund established in Victoria by public subscription. The fellowship is a gesture of "loyalty, gratitude, and affection" to the British people in recognition of their "rôle in saving civilization in the second world war." It provides for ten months' study in Victoria for the selected candidate, and covers all travelling and living expenses during the period. The upper age limit, for both men and women, is 35. The lower limit is 25 and applicants must be of British stock of 10 years' residence in the United Kingdom. Full details can be obtained from Sir John Lienhop, Victoria House, Strand, W.C.2. Applications will be received during the next four weeks.

Secondary Aluminium Alloy Prices

The Federation of Secondary Light Metal Smelters has announced that following the increase in the price of virgin aluminium as from July 1, 1952, and the Order made by the Ministry of Supply increasing the maximum prices of aluminium scrap as from July 14, its members find it necessary to increase the maximum selling prices of the undermentioned alloys on and from Monday, July 28, 1952, as follow:—

L.M.1, from £163 to £166 per ton; L.M.2, from £181 to £183; L.M.4, from £169 to £172; L.M.6, from £190 to £193; deoxidizing sticks 85/90, from £149 to £151.

IT IS ANNOUNCED that Mr. A. G. H. Pritchett has been appointed general sales manager of Chamberlain Industries, Limited, Leyton, London, E.10, and Mr. D. S. Jordan will act as his deputy. The firm's activities in Scotland are being handled by Gerard Wakeham, Limited, of Carlton House, 26, Blythswood Square, Glasgow, C.2.

Cupola Coke: with Particular Reference to High-ash Coke*

By A. G. L. Lewis

Cupola coke in Southern Africa contains more than 15 per cent. of ash, which is about double the ash content of cokes produced in the Northern Hemisphere. A similar position prevails in Australia and India. The ash content of American and European coke tends to rise so that the subject of the influence of cupola coke ash content upon foundry practice is therefore of more than purely local interest. Attention is also drawn to a world-wide tendency—fluctuations in coke quality. The effect of high-ash coke and variations in coke quality on the production of iron castings from cupola melts are detailed and methods of dealing with these effects are visualized.

Relation of Mining and Coking to Coke Quality

(*a*) Selective mining is usually carried out in the pit to obtain coal which, when blended with other coals or carbonaceous materials, gives by tests and use, a coal suitable for coking. Deviations into a band of unsuitable coal, into the footwall or the hanging, either unintentionally or for more economic mining, has its effect on coke quality.

For example, during 1951, an increase of 2 per cent. in the ash content of coke from one of the Southern African coke makers was observed. This was due to the colliery deciding to mine a wider seam which was more economic. The effect in the foundries was noticeable; when all other possible variables had first been eliminated, the coke was finally suspected.

(*b*) Hand sorting over conveyor belts removes stone, and coal which is visibly high in ash. Washing, using water-flow or special flotation liquids, is intended to remove as much ash, sulphur compounds, or unsuitable carbonaceous matter, as may be possible and/or economical.

It is at this point that the coke maker and the research worker can assist the foundryman. Low-ash coals are not found in commercial quantities south of the equator, so that if the foundryman in the southern hemisphere is to get coke equivalent in quality to that of Europe and America it will be obtained through the reduction of ash content by washing and/or flotation, or by other future methods. At present this is not economical, but it is certain that foundries would pay a premium for low-ash coke, particularly the producers of light-section castings.

The solution of the problem lies through further investigations into the form of association of the ash in South African coals; the development of lower costs, finer grinding methods, and washing plant which will give larger yields of washed coal after finer grinding.

(*c*) Few coals are suitable for coking without further blending with other coals or carbonaceous material. Variations at this stage are reflected in coke quality and the foundryman is dependent on the skill, knowledge and attention to detail of the coke maker. The foundryman's safeguard is control testing of incoming coke.

(*d*) Cokes carbonized below 800 deg. C. contain residual volatiles, are soft, have poor cellular formation, and spell trouble in the cupola. Fast heating through the plastic range to keep down coking time, lowers coke hardness and other qualities. Correct coke-making temperatures range between 800 and 1,200 deg. C. For foundry coke, the higher the temperatures the better the coke; but there is a temperature limit for economical coke-oven operation. Synthetic graphite, electrically carbonized at above 1,800 deg. C. is the ideal cupola fuel but is, of course, much too expensive.

(*e*) In coke ovens, the carbonizing mass of coal may range from 18 in. thick in by-product ovens to much more in beehive ovens. It takes time to enable the centre of such bodies of coke to reach the previously mentioned temperature. Time means less tonnage through the ovens and in these days of shortages it is always tempting to cut down coking time. When this has been done, it is always reflected in foundry control tests.

(*f*) Foundry coke production in South Africa comes from three by-products plants, Wankie, Waschbank and the new plant at Vryheid. The remainder of the output is from beehive ovens in Natal. The characteristics of by-products and beehive ovens and the coke produced are detailed in Table I.

TABLE I.—*Relative Properties of By-product and Beehive Cokes.*

By-Product.	*Beehive.*
Dense coke with high shatter index	Coke tends to friability and low shatter index.
Coke handles and transports well	Coke needs bagging for long-distance transport.
Process economical	Process wasteful to the national economy.
Coke is dark and massive in structure	Coke has tendency to silvery appearance and is columnar.
High initial capital cost	Low capital cost.
Utilises evolved gases for heating	Gases burn to waste.
Higher coke yield	Lower coke yield.
By-products available	No by-products.

Many papers have been written and much investigation has been made into coke properties. There are as many as thirty possible tests, mostly interconnected in interpretation, whilst many, such as reactivity and combustibility tests, have proved inconclusive in relation to cupola operation. Where laboratory tests are made on small weights of coke, true results are always more dependent on correct sampling than on analysis.

For South African conditions, where the majority

* A Paper read before the South African branch of the Institute of British Foundrymen, Mr. J. J. Marais presiding.

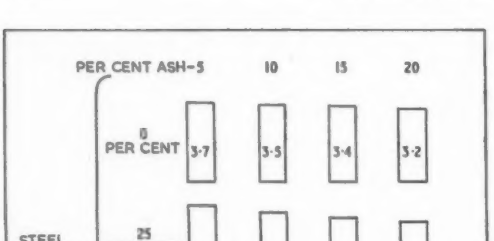


FIG. 1.—*Ash Content of Coke in Relation to Carbon Pick-up for Various Types of Charge.*

of iron foundries have no laboratories, the shatter test is the most reliable and practical control test for incoming coke. With cokes from the same mining areas and ovens, it will be found that, roughly, the shatter-index figure is relative to volatiles, fixed carbon, ignition temperature, macro-structure and cellular formation. Low figures in these tests also indicate poor coke. Coke, particularly when incorrectly carbonized, is not a homogeneous material and the use of bulk samples as for the shatter test is likely to be a closer reflection of a consignment than a small laboratory sample taken for other tests, however much care may be taken in sampling the latter.

Additionally, most of South African foundries are controlled by engineers who have no difficulty in appreciating and installing what amounts to a mechanical test.

For comparison of cokes from different areas, where the washing of coal or mining deviations from normal are possible, ash-content figures are necessary for control purposes. For reliable figures, an analyst experienced in the vagaries of sampling a non-homogeneous material, such as coke, is required; but this test need not be a regular occurrence.

Carbon Pick-up

The final and most important test for foundry coke is the amount of carbon which it will add to the metal melting in the cupola. Carbon pick-up is also the indication of efficiency for cupola melting generally.

The carbon pick-up from cokes in the cupola may be compared with the efficiency of recarburizers in steel-plant practice when bringing up carbon in steel either in the ladle or after slagging on the electric furnace. For example, comparative figures for steel recarburizing in the writer's experience are:

	Ash, per cent.	Pick-up, per cent.
Synthetic graphite (electrode)	Nil	70
Welsh anthracite	4	65
Durham coke	5	60
Transvaal "anthracite"	12	30
Natal coke	16	40

These percentages are the carbon pick-up as related to the weight of carbonaceous material used, variables such as cold metal or slag on metal, being excluded. To determine the carbon pick-up qualities of a coke in the cupola it is essential to base results on a considerable number of melts and to recognize variations which may affect the final figures. Some possible variations are:—

Cupola design.—As may be seen in South African foundries, cast iron may be melted in any sort of refractory shaft so long as metal and coke are charged on to a lighted coke bed and supplied with an air blast at the base. The quality of the whole of an engineering works for many years is dependent on the efficiency of a newly-installed cupola, yet how often does one see less money spent on the melting unit than on one machine in the machine-shop? A cupola design is taken from literature based on overseas practice or copied from thirty or forty years ago.

A good cupola will cut down the amount of highly-priced pig-iron and coke required in the charge to give the required machining properties in the castings. There are many other advantages in these days of pig-iron shortage, such as the possibility of using more steel in white-iron charges. This is because cupola design affects carbon pick-up which is also the basis of a common remark sometimes heard in the foundry that no two cupolas melt alike.

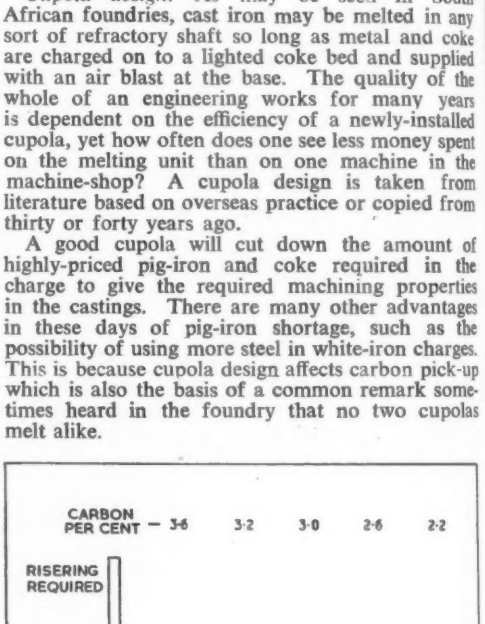


FIG. 2.—*Effect of Lower Carbon due to Increasing Ash on the Necessity for Risering and on the Relative Fuidity.*

Cupola air conditions.—Assuming other conditions are kept constant, variation in coke size will affect air conditions in the cupola. This applies particularly where a centrifugal type of fan is used and no automatic volume control is installed. Blast conditions in turn affect metal temperature and thereby carbon pick-up.

Cupola to be regarded as a precision instrument.—Variation in coke/air ratio is one aspect of how operational control on the cupola can affect carbon pick-up. Other possibilities are the smoothness of charge descent or compaction of the charge in the cupola shaft, due to lining irregularities or bad sizing of metallic charge materials. It is safe to say that the greater majority of South African foundries have no check on these happenings until a batch of bad castings is reported by the machine-shop. More progressive foundries are, however, coming to regard the cupola as a precision instrument. This is done by the centralizing of the necessary controls, similar to blast-furnace and steel-plant practice, which enables the cupola operator to observe instantly any change in melting conditions instead of waiting for metal trouble and then looking around for the cause. Trouble in the furnace inevitably means lower metal temperature and low carbon pick-up.

Bed conditions.—Using high-ash coke, one is constantly operating on the danger line of metal temperatures. Nothing gives more trouble during a melt than a bad start. Optimum bed conditions are therefore essential. If a good bed is not maintained throughout the melt then variable carbon pick-up may be expected.

Iron oxide from charge materials.—Carbon pick-up in the cupola is dependent on the amount of free oxide in the slag, both on the coke surface, and in the well blanketing the metal, through which the metal droplets pass after melting. This oxide slag is derived chiefly from the oxide formed on the surface of the melting charge components in the initial stages of melting. The depth of oxide formed (as will be noted from any dropped charges at the end of a cast) depends on the carbon content of the material, so that whilst pig-iron supplies very little oxide into the cupola slag, mild-steel does so to a much greater extent. In fact, low-carbon plate-steel will lose around one-eighth of an inch from each surface, so that when melting $\frac{3}{8}$-in. thick plate in the cupola one-third of the charged weight of such material will go into the melt, whilst (what is very detrimental) two-thirds will be oxidized into the slag, where it will lower the final ladle carbon analysis. To a lesser degree, this will happen with thin stove-plate scrap, foundry flashings and the like, so that, when carrying out observations on the carbon pick-up qualities of any coke it is essential to keep charge material standard.

Effect of Ash

Table II gives significant data on South African and Indian cokes. It will be noted how these cokes differ from European and American cokes which contain from 4 to 10 per cent. of ash. The difference in ash volume is much greater. Intimate contact comes next to temperatiure in effecting carbon pick-up from the coke by the metal so that the influence of the volume of ash on the surface of high-ash coke will be understood.

Technical literature derived form the northern hemisphere invariably suggests that 10 per cent. ash should be the upper limit to obtain good castings, whilst ironfoundry metallurgists from those parts consistently run into trouble when they base their practice on low-ash coke conditions. The reasons for this are:—

Other conditions (such as those previously mentioned) remaining constant, as the ash in foundry coke increases, metal temperature decreases. With lower cupolas and ladle-metal temperatures come a number of interconnected troubles—lower carbon pick-up, increased liquid shrinkage, shorter freezing ranges, lower fluidities and running properties, poorer finish on castings and increased risering. The early iron foundries in South Africa learnt, not how to overcome these difficulties, but rather to circumvent them. Their practice was established on all-scrap charges, as pig-iron was not available. From hard experience they found that steel in the charge was utterly unsuitable, nothing but heavy scrap was usuable for grey iron; every mould had to be dried and heavily blacked to ensure optimum running conditions, that rod feeding or pumping of risers was necessary and that a mould top of any size which was not heavily nailed, inevitably came down—pulled down by low-carbon metal.

With the introduction of pig-iron, the iron-founder found that more pig in the charge meant less trouble on the floor, but with the ever-increasing demand of the engineer for iron castings with improved physical properties, the modern foundryman has had to learn to get over and not around difficulties associated with high-ash coke.

Fig. 1 shows the relation of ash content of the coke to carbon pick-up, other conditions being equal—based on the Author's observations in different countries. In this illustration, where no steel is

TABLE II.—*Results Obtained from Various Types of Coke.*

	Southern African coke.				Indian coke.	
	Natal Waschbank by-product.	Beehive.	Wankie.	Gasworks.	Bararee by-product.	Beehive.
Per cent ash, by weight ..	16	15	14	17	17	35
by volume ..	32	30	28	34	34	70
Per cent. sulphur	1.4	0.8	1.2	1.0	0.6	0.9
Approx. shatter value (per cent. passing 2 in.)	95	85	95	75	90	85
Approx. carbon pick-up value (syn. graphite = 100) ..	40	35	45	10	40	10

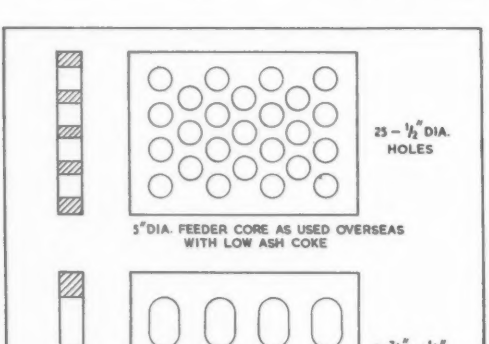

25 – ½" DIA. HOLES
5" DIA. FEEDER CORE AS USED OVERSEAS WITH LOW ASH COKE
8 – ¾" × 1⅛" SLOTS
MODIFIED DESIGN NECESSARY WHEN USING HIGH ASH COKE

FIG. 3.—*Perforated Strainer Cores for Metal Melted with Low- and High-ash Coke Respectively.*

used, the mix is around 50/50 pig-scrap. Steel is based on the use of mild-steel scrap over ¼ in. section. Typical examples are, that in the U.S.A. charges of 75 per cent. steel and 25 per cent. foundry returns gave consistently 3.2 per cent. carbon, whilst in South Africa, a similar charge would average carbons around 2.2 per cent. In India a much higher ash (up to 35 per cent.) beehive coke made under primitive conditions cannot be used for steel-containing charges at all.

Some practical effects in the foundry of increased ash in the coke are demonstrated by Fig. 2, which shows the effect of lower carbon with increasing ash in the coke, on risering necessity and upon fluidity. Fluidity is used rather than temperature, for the foundryman is more interested in how metal runs than in its temperature. (It should be emphasized that the illustration showing risering is entirely diagrammatical and not factual.)

Fig. 3 is used to demonstrate the shortened feeding range of metal melted with high-ash coke as compared with European and American coke. The cores shown are inserted in the necks of heavy risers to facilitate removal. The standard design for this section, used overseas, had to be modified as shown in the bottom drawing of the illustration.

Modification in Running

Lessened fluidity and shortened freezing range, with the tendency to dentritic openness and hair-cracks in high-strength metal of lower carbon content resulting from high-ash coke, all bring a point where the progressive solidification basis of feeding castings is no longer satisfactory and a change must be made to simultaneous solidification principles, such as are used for blackheart malleable and sometimes steel castings.

Apart from these illustrations, it has been found necessary to provide shorter runner systems and distances which metals can be allowed to flow in the mould and still retain the final metal temperatures necessary for sound castings, free from distortion. Overseas methods of choking running metal for cleansing purposes also have to be used with care, lest they reduce metal temperatures too much.

Effect on Machinability of Light Castings

Overseas foundries usually meet any complaint about the poor machining of light-section, repetition castings by increasing silicon and, maybe, the phosphorus content in the mix. Under high-ash coke conditions, this does not always work satisfactorily, as there is not sufficient carbon and temperatures for increased amount of graphitizers to throw out graphite in light-section castings. The remedy under high-ash coke conditions lies in cupola practice, not in the adjustment of charge analysis.

Overcoming Disadvantages

Since most foundries outside Europe and America are compelled to use high-ash coke, it is important to consider how this problem can be met.

(1) By optimum cupola design and operation.

(2) By the use of a suitable low-ash carbon substitute to offset the high ash. Such a material is pitch coke, an oil refinery residue, ash-free but sometimes high in sulphur. A 50/50 mix with high-ash coke would reduce the overall ash to around 8 per cent. Pitch coke is not at present freely available in South Africa.

(3) The use of the coal-fired air or reverberatory furnace instead of the cupola. The air furnace, using pulverized fuel, is actually cheaper than cupola melting due to the price difference between coal and coke in South Africa and India. Final costs, of course, depend on furnace size, method of firing, and furnace operating efficiency but comparative fuel costs are:—

Cupola (Bed, plus coke split at metal:coke ratio of 6:1=12s. per ton of metal melted).
Air-furnace, 3-ton capacity, hand fired: 15 cwt. coal per ton of metal melted.=13s. 6d. per ton melted.
Air-furnace, 20-ton capacity, pulverized-fuel fired: 7 cwt. coal per ton=6s. per ton of metal melted.

(For the above, coke is taken at 72s. on the cupola platform and coal at 18s. per ton d/d at furnace.)

The further advantages of the air-furnace are a much increased metal fluidity over cupola metal using high-ash coke—with all that entails, such as improved machinability of thin repetition castings. There is also possible a more precise control over metal than a hearth furnace can give. The disadvantages are that carbons would tend, with equivalent mixes, to become lower compared with the cupola and that the foundry floor would have to accommodate itself to batch melting. A comparison of refractory costs cannot be made without reference to furnace size and melting efficiency, but would the competitive labour cost be equivalent? Capital outlay on a hand-fired furnace would not be greater per ton/hour than for the cupola furnace, but the initial outlay of the pulverized-fuel-fired furnace would be greater. The latter, however, would be more than offset by a much

Cupola Coke—with Particular Reference to High-ash Coke

lower operating fuel cost. The basic-lined cupola fundamentally gives higher carbon values which will tend to offset the use of high-ash coke.

Conclusions

By these means, foundries compelled to use high-ash coke will lessen the difficulties associated with their use. Coke quality is a world-wide problem. On January 9, 1952, a paper to the British Coke Oven Managers' Association said:—

"Detailed examination of cokes produced in South Yorkshire and elsewhere has shown that two factors are largely responsible for the production of inferior coke. These are (*a*) inadequate preparation of the slack charged to the ovens, and (*b*) incomplete carbonization. . . . Improvement could be brought about by stricter technical control of carbonization."

The paper referred to, makes clear the ways in which such measures could be applied.

It is hoped the present Paper has shown that better coke means better castings. The coke maker, research worker or washery-plant manufacturer, who can make available 10 per cent. ash coke to South African, Indian and Australian foundries, should have a statue erected to him—in high-carbon iron!

Personal

MR. F. A. CALLABY has been appointed financial controller of the Westinghouse Brake & Signal Company, Limited, London, N.1.

SIR FRANK WHITTLE has retired from the post of honorary jet adviser to British Overseas Airways Corporation, which he has held since 1949.

SIR WALTER MONCKTON, Q.C., the Minister of Labour, on July 18 opened a new training school for Rolls-Royce apprentices, in Ascot Drive, Derby.

MR. P. H. WILSON, O.B.E., deputy managing director of Stanton Ironworks Company, Limited, and Mrs. Wilson were guests at the Queen's Garden Party at Buckingham Palace.

MR. A. S. KENNEDY, of Glasgow, who from 1935 until 1944 was secretary and director of Scottish Aviation Limited, Prestwick, has been appointed a director of the De Havilland Aircraft Company, Limited, of which he became secretary in 1945. He is 41.

THE DIRECTORS of British Insulated Callender's Cables Limited announce that they have accepted with regret the resignation of MR. P. V. HUNTER, C.B.E., Hon. M.I.E.E., as a deputy chairman as from August 31st, 1952. At that date Mr. Hunter will be in his 70th year and is desirous of reducing his commitments.

THE Research and Development Division of the British Steel Founders' Association announce that MR. W. E. FULLER has been appointed information officer. Mr. Fuller was, for a number of years, engaged in a similar capacity by the Road Research Laboratory of the Department of Scientific and Industrial Research.

MR. R. C. CROSS has resigned his position as foundry manager and chief metallurgist with David Brown-Jackson Limited, Salford, Manchester, to take up a new appointment with Foundry Services Limited in connection with future developments of the Company in South Africa. Mr. Cross received his initial training in the laboratories of the Steel Company of Scotland and at the Royal Technical College, Glasgow.

MR. ALEXANDER CONDIE, an employee of A. Baird & Son, Limited, ironfounders and engineers, Hamilton, for over half a century, received an inscribed wristlet watch from the directors on his retirement last Friday. From his fellow-foremen—he was in charge of the moulding shop for some years—he received a table-lamp, and from the employees, an armchair and smoking set. He started work with the firm 54 years ago.

MR. DENNIS MYLES, of Arbroath, a student of Dundee Technical College, has been awarded a James Clayton Research Fellowship by the Institute of Mechanical Engineers. Mr. Myers started work at 15 as a store boy before beginning his fitter's apprenticeship with Douglas Fraser & Sons, Limited, Arbroath. In the evenings he studied at technical college and obtained a Higher National Certificate in mechanical engineering and the Hele-Shaw Prize of the Institution of Mechanical Engineering.

DEPUTY MANAGING DIRECTOR of the Austin Motor Company, Limited, Birmingham, MR. GEORGE WILLIAM HARRIMAN, has been appointed deputy chairman of the company to succeed Mr. J. Gibson Jarvie, who recently retired from the board owing to pressure of other business. Mr. Harriman, who is 44, has also been appointed deputy managing director of the British Motor Corporation, the company formed as a result of the merger of the Austin Motor Company and Morris Motors, Limited.

MR. F. D. NICKELL-LEAN, joint managing director of Prince-Smith & Stells, Limited, Keighley, and Taylor, Wordsworth & Company, Limited, Leeds textile machinery makers, has resigned both appointments and Mr. R. Chiles has been appointed managing director of Prince-Smith & Stells, Limited. Mr. Nickell-Lean, who is junior vice-president of Bradford Chamber of Commerce, has been connected with the firm of Prince-Smith & Stells for 27 years, being appointed to the board in 1935 and becoming joint managing director in January, 1951.

MR. F. BRADLEY, a director of J. B. & S. Lees Limited, West Bromwich, whose appointment as chairman of the West Bromwich, Smethwick and District Manufacturers' Association was confirmed at the Association's annual meeting last week, is widely known in the foundry industry and for three years was chairman of the Midland Area Training Committee of the British Iron and Steel Federation. His appointment as chairman for the forthcoming year of the Association creates a precedent in that he is the first man to hold that office twice—his last period being in 1946. Aged 52, Mr. Bradley has been on the Board for several years, of the firm he first served as an office boy.

TO HELP its members to give an adequate and balanced service to consumers, the London and Counties Coke Distributors' Association has appointed a technical officer, whose duty it will be to give assistance and advice on technical problems connected with coke and coke-burning appliances. MR. DONALD GREENHILL has been appointed to the post. From 1947 to 1950 he was with the carbonization branch of the National Coal Board, and was also the Ministry of Fuel and Power's district representative for hard coke for London and the south of England. In May, 1950, he left London to become deputy coke officer of the North-Western Gas Board. He will return to London on August 1 to take up his new position.

I.B.F. National Works Visits

In view of the outstanding success of the two previous annual national works visits days, the Institute of British Foundrymen has decided to repeat the function this year, and has accepted the offer of the Wales and Monmouth branch to make the arrangements. These works visits supplement the arrangements which are already made by branches and those afforded at the annual conferences, and in particular enable those members who cannot spare the time to attend the whole of the annual conference to take part in an annual national gathering. The arrangements made by the Wales and Monmouth branch are as follow:—

Visits will take place on Friday, October 24, and a large number of important foundries in the South Wales area have kindly agreed to receive parties of members. These foundries have been divided into groups of two. Each group of visits will consist of a visit in the morning and a visit in the afternoon. Luncheon will be provided at some suitable place about mid-day. Members are asked to indicate on a reply form which group of visits they wish to attend and, as the number permitted to attend each group is strictly limited, their second and third choices. In the evening, at 7.30 p.m., there will be a dinner at the Sea Bank Hotel, Porthcawl.

Programme of Works to be visited by kind invitation of directors and managers of each Company.

Party.	Morning visit.	Luncheon.	Afternoon visit.
A.	Abbey Works Reception Centre, Stormy Down, Glam.	Abbey Works Canteen.	Steel Co. of Wales, Limited, Abbey Works, Margam, Port Talbot.
B.	Glanmor Foundry Company, Limited, Llanelly (chilled-roll and electric steel foundries).	Local hotel ..	Richard Thomas & Baldwins, Limited, Landore, Swansea (ingot mould foundry).
C.	Brown Lenox & Company, Limited, Pontypridd (steel foundry, chain makers, castings and heavy forgings.)	Works canteen (Brown Lenox).	Goulds Foundries, Limited, Newport, Mon. (jobbing and mechanized foundries).
D.	Saunders Valve Company, Limited, Cwmbran, Mon. (valve makers).	Newport Hotel..	W. A. Baker & Company Limited, Newport, Mon. (jobbing and mechanized foundries).
E.	J. Williams & Sons, Limited, Cardiff (alloy and high-duty iron foundry, engineers and metal-window makers).	Works canteen (J. Williams & Sons).	Cardiff Foundry & Engineering Company, Limited (machine-tool and engineers' castings).

The starting points and times at which the coaches will leave for the various visits are, for visits "A," Seabank Hotel, Porthcawl, at 11.00 a.m.; visits "B," Seabank Hotel, Porthcawl, at 9.00 a.m.; and visits "C," "D," "E," General Electric Buildings, Cathays Park, Cardiff, at 9.15 a.m.

Special transport will be available without charge on Friday night after the dinner to convey members who desire to return home to Cardiff, Swansea and Llanelly. Members wishing to take advantage of these services are required to indicate this on the reply form in the appropriate space. The charge for each group of works visits, including transport by coach, luncheon, gratuities and administrative expenses, is 22s. 6d., and

(*Continued at the foot of col.* 2)

the additional charge for the dinner in the evening at the Sea Bank Hotel is 17s. 6d. Members who desire to participate are requested to return a reply form to the Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester 3, not later than August 21.

Members participating are requested to make their own arrangements for hotel accommodation, and are advised to book at the earliest possible moment after receiving confirmation from the Institute that their bookings for particular visits are accepted.

Notes from the Branches

West Riding of Yorkshire

The annual general meeting of the West Riding of Yorkshire branch of the Institute of British Foundrymen was held at Bradford Technical College. The honorary secretary (Mr. Griffiths) presented his report, in the course of which he said: This year the activities of the branch have been mainly concerned with papers. The inaugural meeting was the usual tea provided by the president, a most enjoyable event. This was followed by an excellent paper on the training of apprentices, given by Mr. J. Colwell, a branch member. The "Brains Trust" as usual gave the expected successful evening, and thanks are due to the erudite question-master, Mr. F. K. Neath. Much interest was shown in the report by Mr. G. L. Harbach on "Synthetic Resins." Another member, Mr. K. H. Collinson, presented an excellent Paper on the "Design of Iron Castings," a subject rather controversial, especially to the foundryman. Members are indebted to Mr. Farmer and his assistant for their Paper on "Running and Feeding of Castings." Mr. Hudson being unable to be with us to present the report and film on the Brass-foundry Productivity Team's visit to the United States of America, they were given by another member of the team.

Another notable event was the Paper by Mr. Nicholls and Mr. Kershaw entitled "A System of Recording Casting Defects." It was a very instructive evening. Members were again indebted to Mr. G. W. Nicholls for his presentation of the Grey Iron Productivity Team's film. It is unfortunate that more works visits cannot be arranged, the chief difficulty being the inability of most firms to cope with so many members at once. Nevertheless, the branch was entertained to an interesting tour of the works of Hepworth & Grandage. On the social side, the annual dance was an outstanding success. Mr. Colin Gresty, the national president, and Mr. Tom Makemson, the general secretary, were the chief guests.

Mr. Sutcliffe gave a report on his activities as librarian and Mr. Nicholls about the work of the Technical Council. Mr. Worcester then reported on the S. W. Wise Memorial Fund, and appealed to the younger members to prepare papers, because it was not only an education to themselves, it was an education to them all.

After a vote of thanks to retiring officers, the meeting proceeded with the election of officers, which resulted as follows: as *president*, Mr. Anderson; as *vice-presidents*, Mr. Johnson and Mr. Sunderland; as *hon. secretary*, Mr. Griffiths; as *hon. treasurer*, Mr. Kelly; as *hon. auditors*, Mr. H. Forrest and Mr. W. G. Thornton; as *hon. librarians*, Mr. Sutcliffe and Mr. Worsnop; as *members of Council*, Mr. Hallas, Mr. Bolton, Mr. Allard, and Mr. Illingworth; as *representative on the Technical Council*, Mr. Nicholls; as *representatives on the General Council*, Mr. Worcester, Mr. Hammond and Mr. Blakiston.

Nitrogen Degassing & Metal Mould Reaction in the Production of Gunmetal Castings*

By E. C. Mantle, M.Sc., A.I.M.

The work to be discussed was started long before productivity teams were thought of, and is, in fact, based on research work published as long ago at 1944. *The research was largely done by Mr. Baker, at present research manager of the British Non-Ferrous Metals Research Association, and the present Author's part in the work has been concerned only with the practical application in foundries of the results he obtained in the laboratory. Although the work had nothing to do with the visit of the productivity team, it has nevertheless quite a lot to do with productivity.*

There are various ways in which productivity can be increased in the foundry. One can improve the layout, one can introduce new casting methods, one can give the workpeople better incentives; but one can also increase productivity by cutting down the amount of scrap produced and by making a more consistent product. This is especially so in the case of valve foundries where often a considerable amount of machining is done only to find that a casting has to be rejected through lack of pressure-tightness. This paper will be concerned mainly with the reduction of wasters in the production of gunmetal castings to withstand pressure.

The development work discussed was carried out in the foundry of Newman Hender and Company, Limited, but it would be wrong to give the impression that this foundry was making an undue number of leaky castings. In fact the reverse was the case, but like all founders making valves, they have their share of castings which are troublesome, and the farsighted management of the firm said "Well, if there be a tool which will help to replace the scrap, here's the foundry—now 'get busy'."

Assessment of the Problem

Before going on to discuss the work carried out, some idea of the difficulties will be detailed. Fig. 1 shows a section of a small valve body which, at the time this work was started, was giving an undue number of leaky castings. It will be seen that this is a relatively thin-walled casting with heavy hexagon shapes at each end. These hexagons, because of their size, cool much more slowly than the thinner sections of the casting and tend to act as local feeders for the surrounding parts of the casting. At the same time, they themselves become isolated from the sources of feed metals, because of the freezing over of the gates, and they therefore tend to become much more unsound than neighbouring parts of the casting. Consequently, leakage occurs at the point indicated in the illustration. Fig. 2 shows a typical case of a thicker-section casting where leakage troubles were being experienced. Here again, there is a massive section which acts as a local feeder for the surrounding parts of the casting, but is not fed itself because of the freezing over of the ingates. Again leakage occurs at the points indicated by the arrow.

Laboratory Investigation

For the laboratory work a simple casting was chosen which had the essential features of the castings shown previously. It consisted of a 5 in. dia. disc with a heavy boss at the centre through which the disc was run through a small ingate. This ingate would quickly freeze over and prevent hot metal reaching the heavy boss, which because of its thickness would remain hot and tend to act as a local feeder to the surrounding parts of the casting. Large numbers of these discs were cast in phosphor bronze and gunmetals to investigate the way in which the unsoundness of the casting was affected by the melt quality. These discs were tested for leakage in both the as-cast condition and after machining all over.

At the time this early work was done, the leaded gunmetals were less popular than they are now and most of the results were obtained using 90/10 phosphor-bronze or Admiralty gunmetal. Since phosphor-bronze shows the effects of gas pick-up more clearly, results obtained with this alloy are used as an illustration of these effects. Later, confirmatory tests were made with the leaded gunmetals, 85/5/5/5 and 86/7/5/2 alloys. These tests showed that these latter alloys, especially the

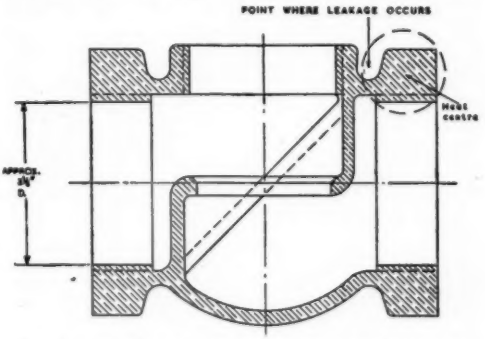


FIG. 1.—*Small Valve Body in which Metal/Mould Reaction has been Successfully Employed to overcome Leakage.*

* Paper presented at the Brassfoundry Productivity Conference, Harrogate, June, 1952. The Author is attached to the British Non-Ferrous Metals Research Association.

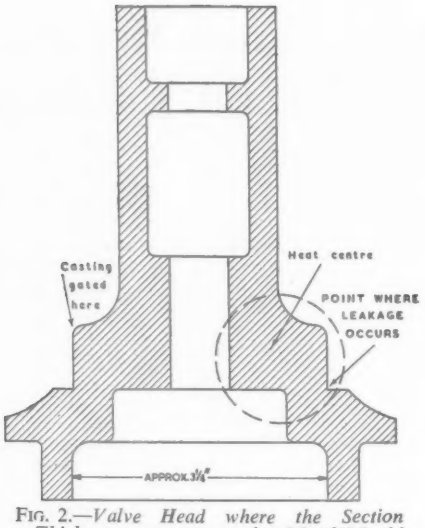


FIG. 2.—*Valve Head where the Section Thickness was so great that Metal/Mould Reaction was only Successful in preventing Leakage when Low Pouring Temperatures were used.*

85/5/5/5 type, were less liable than the lead-free alloys to develop localized unsoundness and consequently are more suited to the production of pressure-tight castings. Nevertheless, when the ingate to the boss of the disc casting was even more restricted so that the test was more severe, the castings regularly leaked when made from degassed metal, and the effects of gas in the metal showed the same trends as with phosphor-bronze.

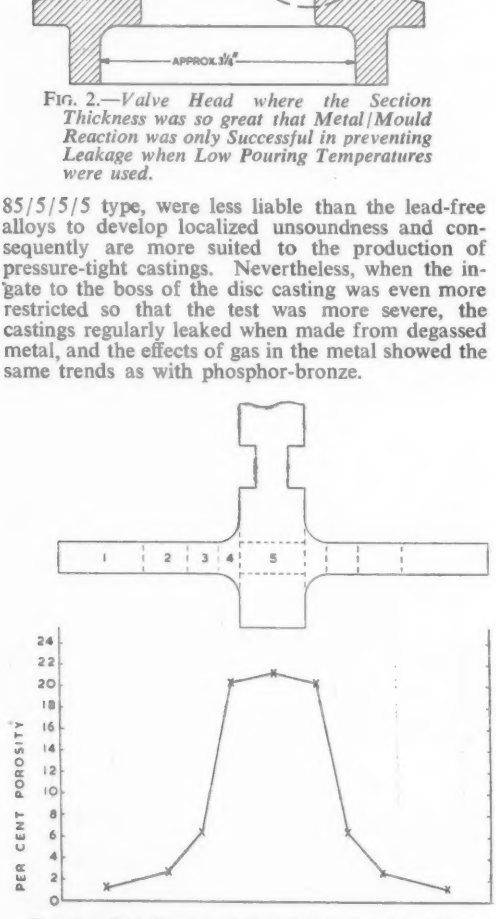


FIG. 3.—*Distribution of Porosity in Sand-cast Tin-bronze Discs made from Gas-free Metal.*

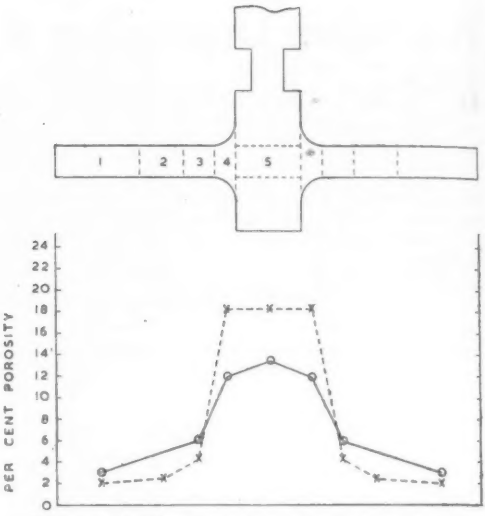


FIG. 4.—*Distribution of Porosity in Sand-cast Tin-bronze Discs made from "Gassy" Metals. (Broken line, low gas-content; full line, higher gas-content.)*

Figs 3 to 5 show the trend of the results obtained.

(1) When the metal used to make these castings was free from gas, the discs tended to be unsound under the boss (Fig. 3) but sound in the surrounding thinner sections. These discs usually leaked.

(2) The distribution of the unsoundness was very similar when the discs were made from gassy metal

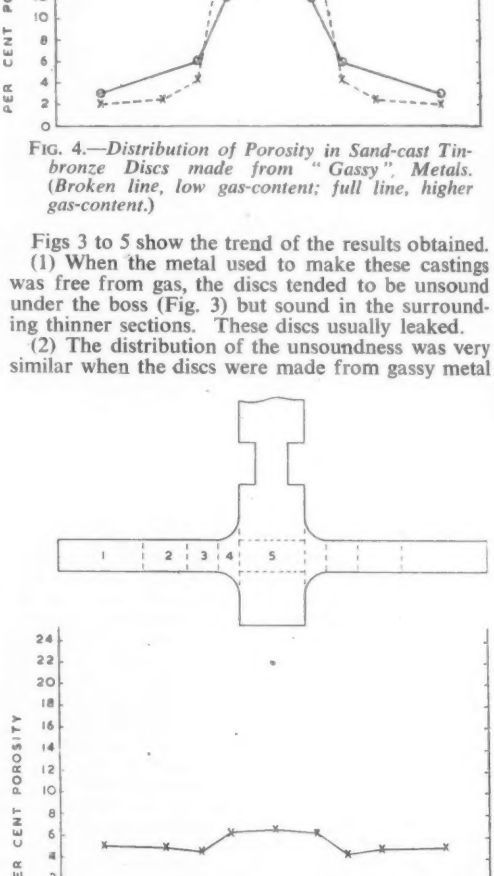


FIG. 5.—*Distribution of Porosity in Sand-cast Tin-bronze Discs made from Gas-free Metal when Gas is absorbed through Metal/Mould Reaction while the Casting is Freezing in the Mould.*

FIG. 6.—*Apparatus used for the De-gassing of Molten Non-ferrous Metals by Nitrogen, passed into the Melt through a Refractory Tube.*

(Fig. 4) although the thinner sections were rather unsound as well as the boss. Again most of the castings leaked.

(3) When the metal contained only a small amount of gas, the distribution of unsoundness was rather more uniform and in this case a large percentage of discs were pressure-tight even in the machined slate. Evidently then, to make castings of this kind to withstand pressure, a small amount of gas in the metal is helpful, but this requires to be carefully controlled.

All this refers to melts which had been deliberately allowed to pick-up a certain amount of gas during melting, but there is another way in which bronzes and gunmetals can pick up gas. When these alloys contain more than a certain amount of phosphorus, they absorb gas by reacting with the steam produced when the hot metal is poured into a sand mould. This reaction is known as metal/mould reaction and the amount of gas absorbed in this way may be carefully regulated by adjusting (1) the phosphorus content of the alloy, and (2) the pouring temperature. An increase in either of these causes an increase in the amount of gas absorbed by the metal.

In the laboratory experiments, it was found that if metal which had been melted free from gas was induced to absorb gas in the mould by means of suitable phosphorus additions, the resulting disc casting had a much more uniform distribution of the unsoundness in it and all the discs were sound on pressure testing even after machining all over (see Fig. 5). Evidently this is a very useful method of preventing the sort of localized unsoundness which gives rise to leakage. The phosphorus addition necessary to produce a suitable degree of metal/mould reaction in gunmetals is about 0.05 to 0.08 per cent., when the pouring temperature is in the range 1,100 to 1,180 deg. C. It should be noted, however, that for the successful application of this method, the metal should be free from gas before being poured into the mould, otherwise the extra gas absorbed through the mould reaction may aggravate the unsoundness.

Foundry Development Work

Following this laboratory work, the next stage was to take the results into the foundry to see whether they could be applied in practice. The first experiments were made with the thin-walled valve body shown in Fig. 1. In all this work the alloy used was 85/5/5/5 gunmetal, and the melts were made in 400-lb. tilting crucible furnaces either coke-fired or oil-fired. In the first experiments, a 400-lb. charge was melted without making any alterations to the melting procedure. Neither was the moulding altered in any way. Half of the 400-lb. melt was cast in the usual way adding only sufficient phosphor-copper to deoxidize the metal. The castings were poured at about 1,180 deg. C. To the other half of the melt sufficient additional phosphor-copper was added to raise the phosphorus content to between 0.06 and 0.08 per cent. phosphorus in order to promote the metal/mould reaction. The results of these first trials are shown in Table I. It is quite clear from these results that the metal/mould reaction caused by adding the extra phosphorus has had the expected beneficial effect.

TABLE I.—*Results of First Trials on Gunmetal Castings of the Type Shown in Fig. 1.*

Heat 1 ..	Normal procedure	44 sound castings, 13 "leakers."
Heat 1 ..	Extra 1½ lb. 15 per cent. phosphor-copper added to 200 lb. metal (0.08 per cent. P added)	50 sound castings, 0 "leakers."
Heat 2 ..	Normal procedure	76 sound castings, 8 "leakers."
Heat 2 ..	Extra phosphorus added as above	52 sound castings, 0 "leakers."

Another casting which was giving trouble was the valve-head illustrated in Fig. 2. With this casting, very variable results were obtained, sometimes all the castings from a melt being sound while at other times upwards of 50 per cent. of the

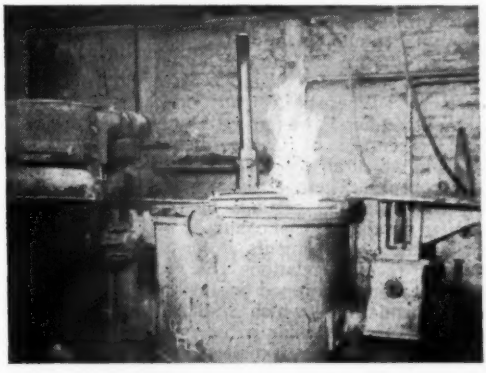


FIG. 7.—*Nitrogen Degassing Apparatus in position on the Furnace. Gas is taken from a Cylinder and a Flowmeter is included.*

TABLE II.—*Leaky Castings Using a 2-in. Valve as the Experimental Basis.*

Heat.	Pouring temp., deg. C.	Gasiness of metal, as shown by voids in D.T.D. bar expressed in percentage.	Pressure-test results.	
			Sound.	"Leakers."
1	1,200	3.0	7	7
2	1,130	2.2	12	2
3	1,120	3.0	4	10
4	1,120	1.2	14	0
5	1,080	1.6	14	0

castings would leak. The Author was therefore asked to try out this new technique on this job. Some experiments were carried out, similar to those outlined, but the results were far from satisfactory and it appeared that in most cases the addition of the extra phosphor-copper to promote metal/mould reaction tended to increase the number of "leakers" produced. However, it soon became apparent that the trouble was associated with the pick-up of gas by the metal during melting.

In all these practical trials, D.T.D.-type test-bars were poured at the same time as each batch of castings, and these experiments demonstrated the value of casting a suitable test-bar at the same time as the production castings in development work of this kind. Density measurements were made on these test-bars to determine the extent of the unsoundness in them (the percentage voids) which is a gauge of the gassiness of the metal. Table II shows how the number of leaky valve-heads was affected by the gassiness of the metal used. It will be seen that, as the metal becomes more gassy, so the percentage of leakers produced from the melt increases. It is therefore clear that to make these castings sound one needs to use metal which is initially free from gas. Without this indication of the gas content of the metal which the test-bars provide, it would be impossible to draw conclusions from these results.

Subsequently, further extensive trials were carried out on this valve-head, involving some thirty 400-lb. heats of metal. In these trials, the melts were in all cases thoroughly degassed by scavenging with nitrogen and extra phosphorus was added to promote mould reaction. The results clearly showed that using this technique this valve-head could be produced sound with a fair degree of certainty. Whereas normally, the average percentage of "leakers" was about 10 per cent., the average percentage of leakers produced during the trials in which all the melts were degassed was only 2 per cent. These experiments, by the way, involved some 450 castings of this pattern and a similar number of castings from two other patterns. From these experiments it was possible to give definite recommendations for reducing the number of castings scrapped because of leakage. These recommendations, which should be applicable to any work of a similar nature, are twofold. First, to de-gas all melts as a matter of routine by scavenging with nitrogen or some equally efficient method. Secondly, to add sufficient phosphor-copper to increase the phosphorus content of the metal to between 0.05 and 0.08 per cent. It is important to apply both these measures; one without the other may be unsuccessful.

Technique of Nitrogen Degassing

The Author believes that bronze founders are scared of the gas-scavenging of melts, but actually the technique is very simple and practically foolproof. The set-up used for this work is illustrated in Figs. 6 and 7, though it is comparatively crude and could be improved considerably. The nitrogen is taken from a cylinder and needs no drying provided that the cylinder is renewed when the pressure falls to 20 atmospheres. The cylinder is fitted with a diaphragm-type reducing valve which gives a line pressure of about 10 lb. per sq. in. This is quite sufficient to force the gas through the metal. A flow-meter is useful and it is common to work with a flow of about 5 litres of gas per min. Alternatively, one can gauge the flow by watching the disturbance of the metal.

The nitrogen is passed into the melt through a refractory tube, which may be either of the plumbago type or of graphite. Several types and sizes of tubes are now on the market. All these tubes are to some extent fragile, but when they are handled in the sort of holder shown in Fig. 6 breakages can be avoided. When the metal has reached the necessary temperature, the furnace is switched off, the gas flow is started, and the tube lowered into the melt for 5 min. That is all there is to it. The amount of nitrogen used is quite small and the cost is not more than one or two pence per melt. With gunmetals, very little fume is produced and metal losses are very low. Furthermore, with this efficient method of degassing, precautions need not be taken to prevent gas absorption during melting, and melts may be made under a charcoal cover without using fluxes, so keeping melting losses to the absolute minimum and reducing the rate of wear of refractory crucible which arises from attack by oxides and other slags.

There are two main points which need emphasis. (1) The use of nitrogen scavenging of metal to ensure consistent melt quality, coupled with the use of metal/mould reaction is an aid to producing pressure-tight castings. (2) Methodical investigation of problems which arise in the foundry is shown. A systematic examination of the problem will often reveal the fault and point the way to the cure. Not only does one reap the benefit of this methodical examination of the problem in the case of the casting under consideration, but once one has found out the answer the experience can be added to the store of knowledge to help with similar problems in the future. The resources of the British Non-Ferrous Metals Research Association are there to help industry with these investigations into production troubles.

The Author's thanks are due to the directors of Newman Hender & Company, Limited, in whose works all the practical trials described above were carried out; and both to the firm and to the director and Council of the British Non-Ferrous Metals Research Association for permission to publish this account.

DISCUSSION

MR. L. BUCKLEY (Newman, Hender & Company, Limited) felt that possibly from the foundryman's angle a little additional information was needed to assist the practical application of the work. At times in a foundry, a particular job, although it did not produce wasters regularly, gave rise to trouble which was not fully explicable. Mr. Mantle's illustrations showed that residual gas or gas pick-up from the metal to an extent varying from 3 per cent. down to 1.6 per cent. would be practicable for any foundry foreman to point out or see, or even find. In that particular job the stage was reached at which they could not achieve consistency in the castings after machining. But the nitrogen degassing, although it was very crudely done, was definitely very effective, and there was no doubt that the Research Association had done an extremely good job of work in pin-pointing that particular fault.

At Mr. Buckley's request, a film was then shown illustrating the degassing set-up. It showed a metal cover-plate lined on the underside with refractory material, and a tube passing through this to within 4 in. of the bottom of the melt. In the film, he said, the gas flow appeared to be rather high, in order to exaggerate the effect of disturbance (*i.e.*, the scavenging action), though it need not be quite to violent in practice. The method was simple, and involved very little expense.

When the research workers had made the investigations on the test-bars and had found the effects of residual gas, they had tried to make an actual gassy melt. They had used a charge containing 45 per cent. of oily swarf and, astonishing though it might seem, they did not get a gassy melt; that sort of thing indicated what the foundry foreman was up against. The work described in the Paper gave a means of achieving consistency in castings and, along with that, increased productivity.

MR. D. W. BROWN (Morgan Crucible Company, Limited), referring to melting furnaces, said undoubtedly lift-out furnaces gave flexibility in dealing with different alloys and outputs and were perhaps the most useful furnaces for the jobbing brass foundry. Tilting furnaces had the advantage that they gave better working conditions in particular, and their use was justified where more than a ton of any one melted alloy had to be provided every day. The choice of fuel for melting was very much a local matter and fuel costs varied very considerably in different parts of the country. Melting could be done satisfactorily with gas, oil or coke, and in some cases with other fuels. American foundrymen had the advantage of cheap supplies of natural gas in many instances; Table III in Appendix III of the Report gave comparative fuel costs in this country, but Mr. Brown emphasized that it applied to only one part of the country. In London, founders had to pay just about twice as much for gas as was stated in the Table; on the other hand, oil was somewhat cheaper in London than the figure quoted.

Mr. Brown then showed a film on oil-firing techniques for crucible furnaces in the course of which nitrogen degassing as carried on at Morgan's foundry was illustrated. With the 120-lb. crucibles used in the furnace pictured, the cost of nitrogen degassing the metal was about ½d. per pot, and the equipment cost about £20.

DR. K. STRAUSS (Foundry Services Limited) said a number of articles, mainly sponsored by the manufacturers of nitrogen, had appeared in the American technical press, but the speaker understood that nitrogen degassing of copper alloys was not practiced on any large scale in the United States. In this country, nitrogen was used on a still smaller scale for the degassing of heavy metals. That might be due to the fact that oxidizing fluxes had been available for many years, and extensive research by the British Non-Ferrous Metals Research Association and by the Tin Research Institute had shown that such materials were effective degassers of these alloys.

There was no doubt, Dr. Strauss continued, that nitrogen could be used effectively for degassing copper alloys, but there were a number of disadvantages, one of the most important of which was the difficulty of handling gas cylinders in a production foundry. Foundrymen, not only in this country but all the world over, disliked to handle gases in cylinders, be it chlorine, nitrogen, or any other gas. There were instruments which could go wrong and tubes which might block up and, as nitrogen treatment had to be carried on for at least five minutes in order to give satisfactory results, metal tubes could not be used and even the best non-metallic tubes were fragile, so that the percentage of breakages tended to be high in ordinary foundry procedure.

Oxidizing fluxes not only reacted mechanically but also chemically in oxidizing hydrogen which was mainly responsible for gas unsoundness. Most of the tests which had been carried out with nitrogen degassing had been done on coke or oil-fired crucible furnaces. According to his knowledge, no results had been reported on metal melted in reverberatory furnaces, where the gas pick-up was generally much higher than in crucible furnaces, and where the large surface area and the shallow metal bath were definite obstacles to a successful introduction of nitrogen. Oxidizing fluxes were practically foolproof to use and the results obtained were at least equal to those obtained with nitrogen. In block form or powder form they could be plunged into the metal or left as a covering flux and, if the composition of those oxidizing fluxes were adjusted correctly, the attack on the crucible would be negligible.

It was generally assumed that nitrogen delivered from a cylinder was dry, provided the pressure did not fall below 300 lb. per sq. in. However, his company had found that the moisture content of the gas taken from a full cylinder was 0.32 mg. per litre, and 2.7 mg. per litre in a quarter-full cylinder. That meant that 50 litres of nitrogen would produce 80 ml. of water in vapour form (calculated at approximately 1,100 deg. C.) for a full cylinder and approximately 650 ml. for a quarter-full cylinder.

For assessing the quality of metal before it was poured into castings, the ordinary D.T.D. test-bar

Nitrogen Degassing and Metal Mould Reaction in the Production of Gunmetal Castings—Discussion

was of little use, and in order to overcome those difficulties the American Foundrymen's Society had developed a fracture test with 85/5/5/5 gunmetal. That was carried out by casting a 6 by 3 in. rectangular block ¼ in. thick in an oil-sand mould. The test took only three minutes to complete and, therefore, could be carried out whilst the metal was still in the furnace. Full particulars of the test were given in the Brassfounders' Productivity Report, and its adoption in foundries might provide a useful tool for the quick assessment of metal quality. In conclusion, Dr. Strauss said the higher price of oxidizing treatment as compared with nitrogen treatment was amply compensated by the easier application and the fact that the former could be used in crucible, reverberatory and electric furnaces alike.

MR. MANTLE thanked Dr. Strauss for his useful remarks but did not intend to re-open the controversy of gas-scavenging *versus* oxidizing fluxes for the removal of hydrogen from bronzes and gunmetals. This subject had been gone into at great length previously by various investigators.*

Application to Aluminium Alloys

MR. J. ROGERS (Universal Engineering Company) asked what procedure to adopt, and what gas, pressures, etc., for the nitrogen degassing of aluminium alloys L33, D.T.D.424 and similar.

MR. MANTLE replied that nitrogen degassing was developed at the British Non-Ferrous Metals Research Association for light alloys many years ago, before it was considered for bronzes. The process was very similar to that described in the present Paper except that the degassing had to be used in conjunction with a flux which would dissolve aluminium oxide. The flux contained one part sodium fluoride plus two parts sodium chloride, but any similar proprietary flux would do.

MR. C. A. TIMMS (Billington & Newton) mentioned the use of density determinations for calculating voids and relating these to gas contents and resultant casting soundness and asked if Mr. Mantle thought a simple routine density determination could be developed as an inspection operation for the proof of casting quality before machining.

MR. MANTLE said that from a determination of the density, the overall percentage of voids in the whole casting might be calculated. Unfortunately, in most cases, it was not the overall voids in a casting which were important, but the way in which these voids were distributed, and the density of the whole casting gave no indication of this.

* See technical Press.

THE BIRTLEY COMPANY, LIMITED, Birtley (Co. Durham), has received an order valued at £300,000 for the supply of 103 earth scrapers for the United States Air Force in Germany. It is the biggest single order of its kind secured by the company, and delivery is beginning immediately.

New Catalogues

Ring Mounted Axial Fans. It is not easy to present a mass of technical data in an attractive style, but in Publication No. 27, issued by Keith Blackman, Limited, of Mill Mead Road, London, N.17, this has been achieved with remarkable success. The cover is in gold, and on the front page the essentials are cleverly set out in half-a-dozen lines. This 26-page catalogue is divided into four main sections, and with the aid of the contents lists, one can immediately find the type of fan desired. This brochure is the best so far produced by the publicity department of Keith Blackman. It is available to our readers on writing to Mill Mead Road.

Steel Castings. From the Parker Foundry, Mansfield Road, Derby—a special high-duty steel castings plant belonging to F. H. Lloyd & Company, Limited—has been received what is judged to be amongst the best type of trade literature received for many a month. What makes it so effective is the excellence of the illustrations. Whether there be any untidiness in the foundry the receiver does not know, but doubts its existence. However, by close-ups of the various processes used, stress is laid on craftsmanship rather than on the magnificence of plant available. This impression is reinforced by the inclusion of technical data and illustrations of the customers' plant embodying the steel castings they have made. The front cover is so striking that it might well have served also for the back, instead of an aerial view of the works.

Light Alloys. In producing "Hiduminium Technical Data," High Duty Alloys, Limited, of Slough, have radically departed from the traditional by the incorporation of a double spiral binding and the use of "Celloglas" as a finish. The effect is at least novel, if somewhat untidy, due to "wandering" of a few pages from the proper positions in the rings of the spiral, and to the very useful tabs for finding the data sought. The contents of the book are such as to make it indispensable for the engineering designer when exploring the possibilities for including aluminium alloys as components for his constructions. The mass of figures printed cover castings and wrought material—including extrusions and tubes. The catalogue has two great features to commend it—essential usefulness and distinct novelty. The reviewer understands that other editions are available, not so comprehensive as the one under review, but adequate for definite fields of application.

Foundry Supplies. It is usual to assess bulk supplies by the technique of sampling, but one cannot apply this process to a consignment of trade literature. Yet to review separately each one received on the subject of foundry supplies would be too lengthy a task. This is the position in which we find ourselves in the case of seven (though, according to the covering letter, there should have been eight) received from Foundry Services Limited, of Long Acre, Nechells, Birmingham. They divide themselves into two categories, the nicer one being characterized by the use of parallel lines, with the title boldly printed in a panel. Each one has its own colour, gold for "copper and nickel," grey for "iron and steel" and blue for the general listing of the firm's products. The second group, again uniform, is more utilitarian, for being four-page leaflets perforated for insertion in a general catalogue, they carry either illustrations or letterpress on the front cover. The top or bottom are printed in colour and again use is made of parallel-line decoration.

Production of Ingot Moulds by Sandslinger in a Mechanized Foundry*

By J. Raymond Jones

The ingot mould is an essential commodity required for use in steel works and in Landore the management recently completed a new foundry mechanized on the most modern lines to manufacture this product. Ingot moulds are made of cast iron, this being the cheapest material that can be used to withstand without distorting the continuous heating, cooling, and rough handling in a steel works. The new ingot-mould foundry at Landore works of Richard Thomas & Baldwins, Limited, has been built to take care of the major requirements of the Abbey, Margam and Port Talbot Works of the Steel Company of Wales, Ebbw Vale, Redbourne, and the west Wales works of Richard Thomas & Baldwins.

Sizes of Moulds

The ingot moulds required for the Abbey works vary in weight from ten to 22 tons, some being open at the top and bottom and others partially closed or bottle-top moulds, the heaviest made so far being 18 tons. Ebbw Vale moulds vary in weight from six to 11 tons and are all of the open top-and bottom type. Apart from Cwmfelin and occasionally Pontardawe, the west Wales works of R. T. & B. solid-bottom moulds type being favoured by the original R.T. works and plug-bottom moulds by the original Baldwins works. Similar methods are used to make these different types of moulds, broadly speaking the bigger the mould the larger the moulding box in which they are made.

Description of Foundry

The foundry is made up of three parallel bays (Fig. 1). The charging-bay, 240 ft. long by 42 ft. wide; the tapping- and ladle-bay 200 ft. long by 30 ft. wide, and the main production-bay 600 ft. long by 56 ft. 6 in. wide. Midway between the charging-bay and ladle-bay are installed three cupolas—the raw materials being charged from the charging-bay and tapped out molten in the ladle-bay. The charging-bay is serviced by one rail track running its whole length and another short track for coke wagons. It has two electric overhead magnet cranes that can transfer pig-iron, etc., from wagons to the cupola charging skip. The next bay is the ladle-bay, where metal is tapped from the cupola. This is serviced by one 24-ton and one 10-ton overhead electric cranes, two electric transfer-cars to take hot metal to the casting area; as well as a track to take two railway trucks. In this bay there is also a sand moulding floor where box-parts, etc., are made. The other bay, the main production-bay, is serviced by six overhead cranes, two 60-ton cranes with 25-tons auxiliary hoists, one 5-ton, one 10-ton, two 30-ton cranes with 10 ton auxiliary hoists. There are three rail tracks entering at right angles at one end of the building, capable of taking nine wagons and these are used for despatching the finished ingot moulds.

* Paper presented to the Buxton Conference of the Institute of British Foundrymen, Mr. E. Longden being in the Chair.

Drying Stoves

There are eight mould-drying stoves (Fig. 2), four each end of the moulding-bay and directly opposite the Sandslingers and outside the gantry track so that only the bogie rails project into the working bay and thus floor space is saved.

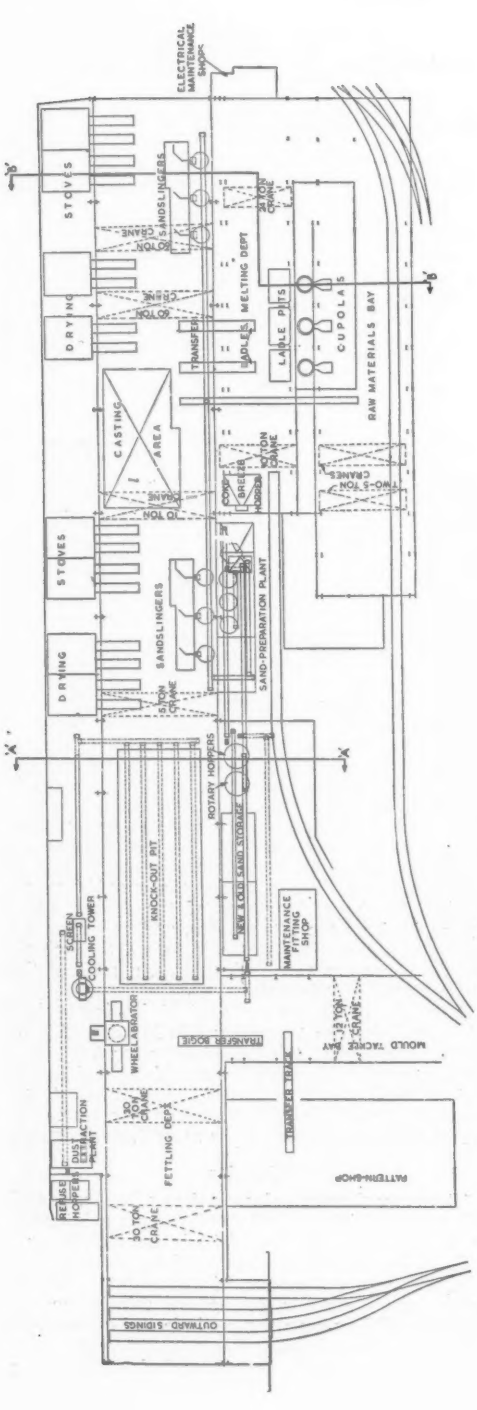
Size.—Each stove is 25 ft. wide, 18 ft. deep and 12 ft. high, they are lined with insulating brick and each has two open-frame bogies which run on roller cages and are pulled in and out by the overhead cranes. The hollow steel lifting doors are filled with insulating material. The heating unit is built on top of the stove and is fired by gas burners using producer-gas as fuel.

A recirculation system of drying is used, this comprises a fan which draws air from inside the stove and pushes it through a large duct and into the burner end of the firing chamber. The reheated air and hot gases leave from the bottom at the opposite end through ducts which pass through the roof of the drying chamber down the end wall and between the bogie rails and under the bogies. There are a series of slots in this bottom ducting and the hot air and gases rise directly under the moulds on the bogie. In the early stages of the drying, air is drawn in from the atmosphere, and as pressure is built-up in the stove, steam is forced through the stack. When the steam dies down, a recirculation system is brought into use.

A minimum drying cycle of 8½ hr. is required, 2½ hr. to bring the temperature to 285 deg. C. after which it is held at this temperature for 6 hr. Gas is then turned off to allow the moulds to cool slightly before closing. The stoves are thermostatically controlled, and six are necessary for maximum production, thus allowing two spare for repairs, etc.

Cupolas

There are three cupolas, as shown in Fig. 1, each being worked in turn and so allowing a cold cupola to be repaired each day. The internal diameter is 5 ft. 1½ in. and the bottom of the cupola is 4 ft. 6 in. above ground level and is closed by half-doors. Just above the doors on the one side is the tap-hole and 22 in. above the tap-hole and on opposite side is the slag-hole. There are two rows of tuyeres, five in each row. Slag is led into a slag



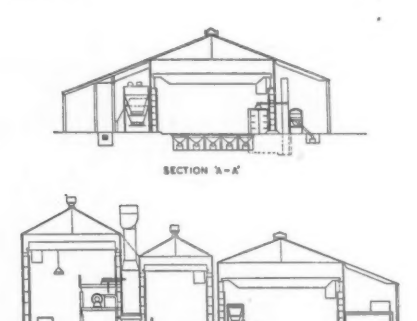


FIG. 1 (*left*) *Plan View of Foundry, showing three Parallel Bays and Distribution of the Main Sections and Operations;* (*above*) *End Elevations at the Positions Indicated.*

pot which is pulled to and from position by a winch at the back of the cupola, and when solid, loaded direct into wagons to go to the tip.

About 25 ft. above the floor level is the cupola stage, a steel platform from which the charging of the cupola is controlled. The cupola is mechanically fed from a charging tray (Fig. 3) which projects into the charging opening of the cupola but rests on a weighing platform outside. Pig-iron is picked up direct from wagons by a magnet suspended from an overhead electric crane and is loaded on to the cupola charging tray. When the requisite amount (2 tons) has been loaded and checked by the dial scale, limestone (100 lb.) is added and the tray which is pivoted near the cupola mouth is lifted by means of a hydraulic ram until the charge slides into the cupola. Following the metal charge, coke is filled into the tray from a coke bin on the stage and when the requisite weight (5 cwt.) is on the tray, this again is charged into the cupola. Metal is tapped out (Fig. 4) in the middle-bay into ladles standing in the cupola pit. When the ladle is full, all slag is skimmed off and the ladle is lifted and placed on the electrically driven transfer-car and taken into the casting bay (Fig. 5). The average melting rate is 12 to 14 tons per hour and the cupolas work two shifts and are capable of turning out 250 tons per day.

Sand Plant

Continuous sand mill.—A departure from normal practice was made when a continuous sand mill was decided on. Previously, in ingot-mould making, batch-type mills were used but it was felt that, owing to the large quantity of prepared sand required, a continuous mill had many advantages over a batch mill, *viz.*:—(1) Intermittent operation as against continuous supply; (2) increased wear and tear of a number of mills as compared with one, and (3) two or three operators necessary instead of one. The mill decided on was a Coleman continuous unit having a maximum capacity of 25 tons per hr. It is provided with a fluid drive having an

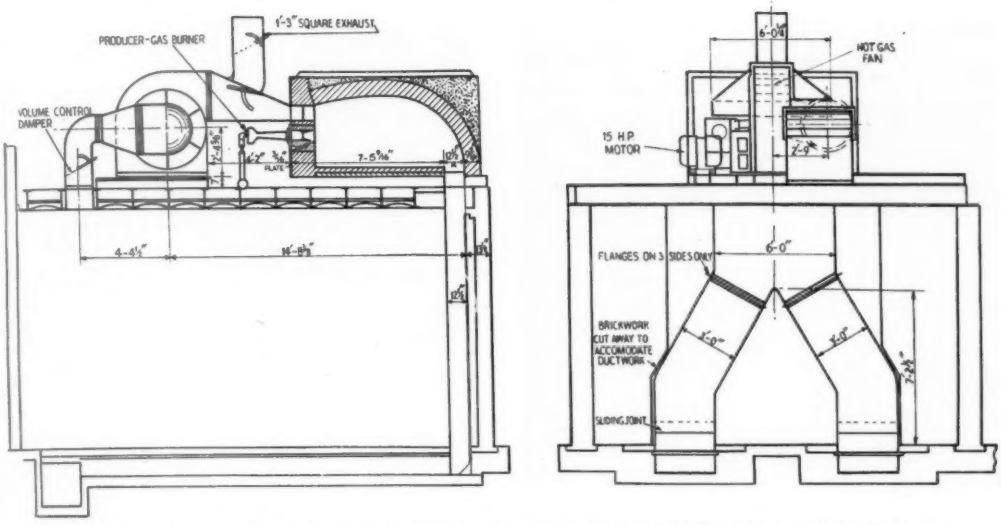


FIG. 2.—*Section and Rear Elevation of a Drying Stove showing the Modification to Permit Optional Recirculation of Hot Gases.*

overloading device and has a saucer-shaped revolving pan, with three fixed conical rollers and scrapers or ploughs set between. This mill, so far, has proved very satisfactory.

Working.—The system sand hopper is directly above the mill and has a shutter arrangement to control the delivery; this is set to give approximately four times as much sand as that coming in from the new-sand belt-feed. Coke breeze is also added from a hopper over the mill. The coke breeze is required to give more "venting" or permeability to the sand; this is necessary to allow the quick escape of gases when casting. Water is added from a tank set to give a controlled moisture content. Sand is delivered from the sand mill and by means of a series of conveyor belts into the various hoppers over the Sandslingers. Samples of sand are taken hourly to determine the moisture content, strength and permeability. New sand is discharged directly from wagons through a grid on to a slat conveyor, is elevated and fed to the main bricked storage-bin of 200 tons capacity, or to a

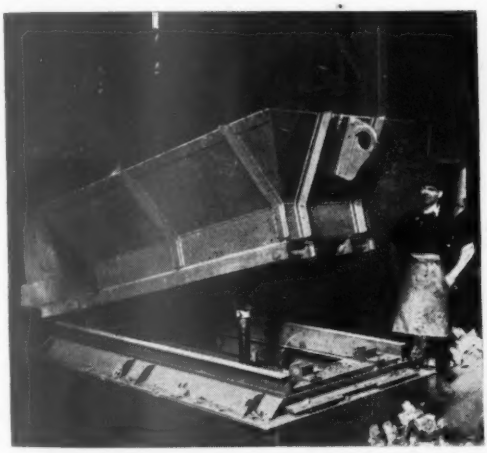


FIG. 3.—*Charging Tray on the Cupola Stage being Tilted Hydraulically from below to Discharge its Contents into the Furnace.*

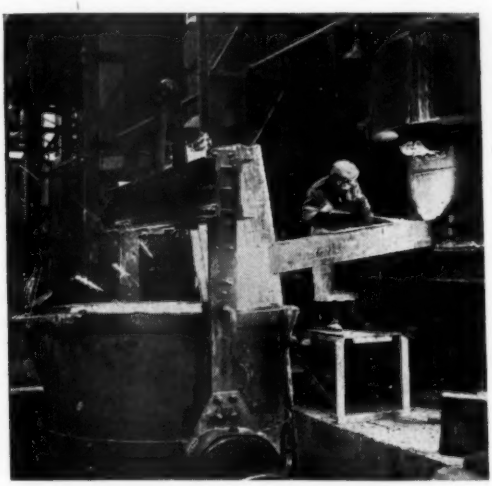


FIG. 4.—*Tapping from One of the Three* 14*-ton-per-hour Cupolas*

FIG. 5.—*Electrically-driven Transfer Car for taking Ladles of Molten Metal to the Casting Bay. The Ladle is placed on the Transfer Car by Overhead Crane.*

FIG. 6.—*One of the Fixed-type Sandslingers used for Ramming Ingot-mould Boxes. The Sand Supply from Conical Hoppers can be seen in the Background.*

60-ton hopper. It is subsequently fed from the hopper at a controlled speed by means of rotary table under the hopper, and by an elevator and belts is sent direct to the Coleman mill.

Sandslinger

The Sandslinger (Fig. 6) is a machine which eliminates the original slow, laborious, hand-ramming methods. The Sandslinger, as the name implies,

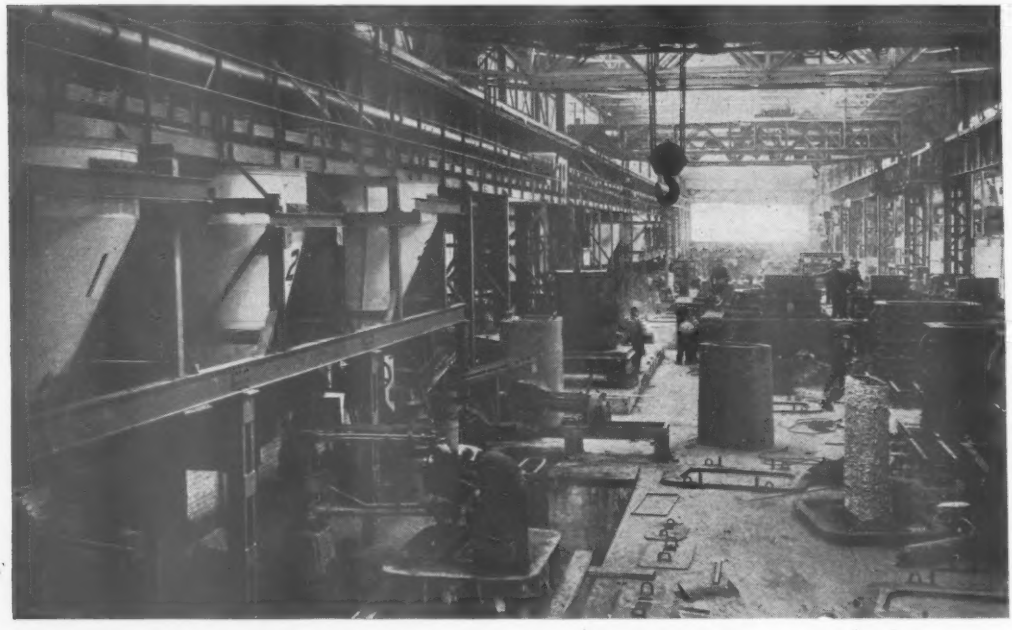


FIG. 7.—*General View of the Moulding Shop, showing (centre) Two Designs of Pattern and (right) a Combined Bottom-box and Straw-rope-wound Core-bar. In the Foreground is a Mould being Rammed, and (rear, centre) is a Ladle of Metal resting on the Transfer Car, preparatory to Pick-up by the Crane for Pouring.*

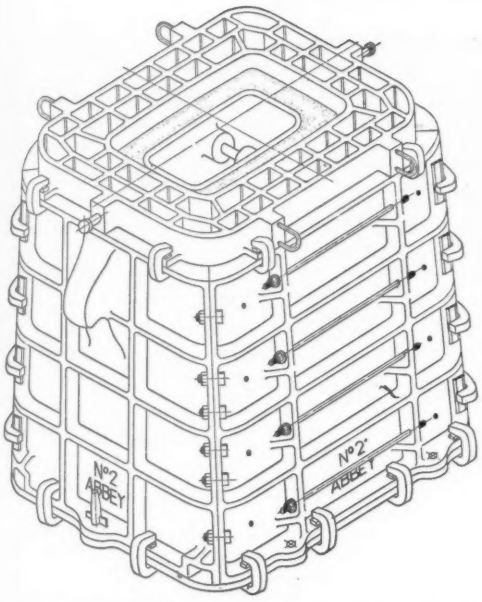
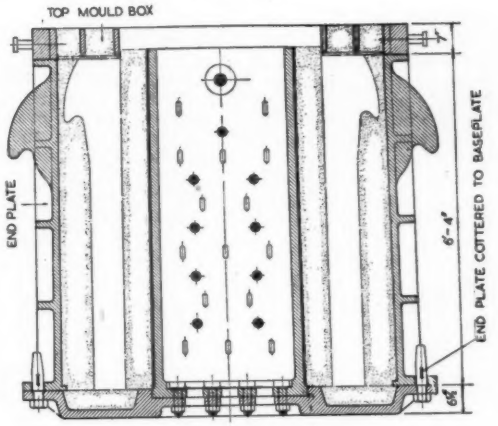
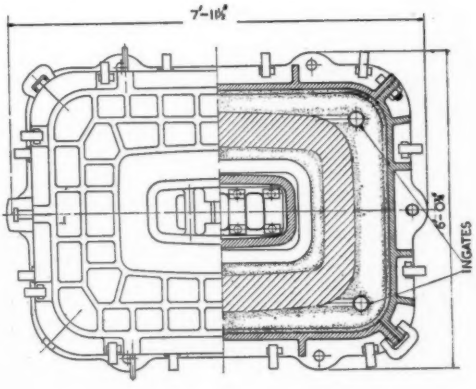


FIG. 8.—*Typical Moulding-box, Core-bar and other Tackle assembled for making One of the Larger Ingot Moulds.*

slings or throws the sand into the box-part. The machine is composed of two or three arms pivoted end to end, each arm carrying a movable belt, the final or end arm having a head in which there is a cup revolving at high speed at right angles to the belt. This head is cased in, but has an opening at the top and bottom, and it is through this bottom opening that the sand is thrown out at such a speed as almost to be invisible. On the head are two handles so that the head can be pulled around and sand can be directed at any point within 15-ft. radius. The machine is controlled by a push-button starter on the head and handy for the operator. When working, sand is fed from a 6- to 10-ton hopper by means of a rotary feed-table on to the first belt of the Sandslinger, then on to the next and following belt, and then through the gap in the top of the head. At this point the cup, which is revolving at 1,440 r.p.m., continuously cuts cupfuls of sand which are thrown out from the bottom opening, and form streams of sand leaving the head at a speed of approximately 70 to 80 m.p.h., the quantity being 10 to 12 tons per hr.



ASSEMBLY OF MOULD TACKLE



HALF SECTION AND PLAN OF MOULD TACKLE

Patterns

Patterns (Fig. 7, centre) for the larger ingot moulds are made in cast iron in one piece identical with that of the finished casting, but are hollow to reduce weight. Moulding box and tackle, etc., include the outside box-part, core-bar and bottom box, top box, and the stripping or guide plate shown in Fig. 8. With the exception of the stripping plate, all are made of cast iron.

(To be continued)

£225,000 Will

MR. BENJAMIN EDWARD TODHUNTER, a director of Murex, Limited, metallurgists, of Rainham (Essex), and Murex Welding Processes, Limited, Waltham Cross (Herts), who died on May 25, left £225,014 4s. 4d. gross. Mr. Todhunter had also served as a director of Imperial Chemical Industries, Limited.

EMPLOYEES of the North-Eastern group of companies comprising the North Eastern Marine Engineering Company (1938), Limited, Wallsend-on-Tyne, Geo. Clark (1938), Limited, marine engine and boiler makers, of Sunderland, and Richardsons, Westgarth & Company, Limited, marine engineers, etc., of Hartlepool, were the recipients of 77 long-service awards at the inter-works sports at Hartlepool recently.

Pig-iron and Steel Production

Statistical Summary of April Returns

The following particulars of pig-iron and steel produced in Great Britain are from statistics issued by the British Iron and Steel Federation. Table I summarises activities during the previous six months. Table II gives production of steel ingots and castings in April, and Table III, deliveries of finished steel. Table IV gives the production of pig-iron and ferro-alloys in April and number of furnaces in blast. All figures in thousands of tons.

TABLE I.—*General Summary of Pig-iron and Steel Production.*

Period.	Iron-ore output.	Imported ore consumed.	Coke receipts by blast-furnace owners.	Output of pig-iron and ferro-alloys.	Scrap used in steel-making.	Steel (incl. alloy).			
						Imports.[3]	Output of ingots and castings.	Deliveries of finished steel.[1]	Stocks.[3]
1950	249	174	197	185	197	9	313	241	997
1951	282	170	206	186	175	8	301	243	589
1951—November	280	192	215	196	182	13	316	253	568
December	278	189	216	198	159	10	288	234	589
1952—January[1]	293	190	222	199	164	13	293	243	540
February	302	187	222	197	177	20	313	236	525
March	56	184	221	202	181	23	320	253	551
April[1]	302	184	224	201	171	29	305	246	575

TABLE II.—*Weekly Average Production of Steel Ingots and Castings in April*, 1952.

District.	Open-hearth.		Bessemer.	Electric.	All other.	Total.		Total ingots and castings.
	Acid.	Basic.				Ingots.	Castings.	
Derby, Leics., Notts., Northants and Essex ..	—	3.4	11.7 (basic)	1.7	0.2	16.1	0.9	17.0
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire	1.5	18.3	—	1.7	0.5	20.9	1.1	22.0
Yorkshire (excl. N.E. Coast and Sheffield) ..								
Lincolnshire	—	30.2	—	—	0.1	30.2	0.1	30.3
North-East Coast	1.4	57.6	—	1.1	0.5	58.8	1.8	60.6
Scotland	4.2	35.3	—	1.5	0.8	39.7	2.1	41.8
Staffs., Shrops., Worcs. and Warwick	—	15.7	—	0.9	0.8	15.7	1.7	17.4
South Wales and Monmouthshire	7.8	54.1	4.7 (basic)	1.1	0.1	67.3	0.5	67.8
Sheffield (incl. small quantity in Manchester) ..	8.8	23.7	—	8.6	0.6	39.6	2.1	41.7
North-West Coast	—	1.6	4.5 (acid)	0.3	0.1	6.4	0.1	6.5
Total	23.7	239.9	20.9	16.9	3.7	294.7	10.4	305.1[1]
March, 1952	24.9	251.3	21.5	18.5	4.0	308.8	11.4	320.2
April, 1951	27.8	252.6	21.4	17.0	3.7	312.7	9.8	322.5

TABLE III.—*Weekly Average Deliveries of Finished Steel.*

Product.	1950.	1951.	1951.	1952.	
			April.	March.	April.[1]
Non-alloy steel :					
Ingots, blooms, billets and slabs[4]	3.6	4.0	4.4	4.7	4.4
Heavy rails, sleepers, etc.	11.3	10.1	10.4	11.2	10.1
Plates ¼ in. thick and over ..	40.0	41.0	43.8	42.1	41.8
Other heavy prod. ..	40.2	39.9	43.4	39.6	39.6
Light rolled prod. ..	47.6	47.1	52.2	45.1	45.0
Hot-rolled strip	19.4	19.5	20.5	18.4	18.3
Wire rods	16.3	16.1	19.0	16.3	15.2
Cold-rolled strip ..	5.5	6.0	6.0	6.3	6.0
Bright steel bars ..	6.3	6.6	7.5	6.6	6.0
Sheets, coated and uncoated	30.5	38.5	35.4	40.0	36.0
Tin, terne and blackplate	14.3	13.9	14.4	16.6	16.3
Tubes, pipes and fittings	20.0	22.0	24.6	23.8	23.5
Mild wire	12.5	11.9	13.1	12.9	12.7
Hard wire	3.5	3.7	4.2	3.8	3.2
Tyres, wheels and axles	3.5	3.7	4.1	3.3	3.7
Steel forgings (excl. drop forgings) ..	2.2	2.3	2.6	2.9	2.7
Steel castings ..	3.5	3.8	3.6	4.3	4.3
Tool and magnet steel	[7]	[7]	[7]	0.5	0.5
Total	280.2	285.1	309.2	298.4	289.3
Alloy steel	10.6	12.3	12.9	15.7	13.8
Total deliveries from U.K. prod.[5] ..	290.8	297.4	322.1	314.1	303.1
Add : Imported finished steel ..	3.8	4.9	4.2	12.2	12.0
	294.6	302.3	326.3	326.3	315.1
Deduct : Intra-industry conversions[6] ..	55.6	61.5	64.4	75.2	71.0
Total net deliveries..	241.0	242.8	263.9	253.1	246.1

TABLE IV.—*Weekly Average Production of Pig-iron and Ferro-alloys during April*, 1952.

District.	Furnaces in blast.	Hematite.	Basic.	Foundry.	Forge.	Ferro-alloys.	Total.
Derby, Leics., Notts., Northants and Essex	24	1.5	18.6	22.7	1.0	—	43.8
Lancs. (excl. N.W. Coast), Denbigh, Flints. and Cheshire ..	6	—	8.0	—	—	0.7	8.7
Yorkshire (incl. Sheffield, excl. N.E. Coast) ..							
Lincolnshire ..	12	—	28.1	—	—	—	28.1
North-East Coast	24	5.7	40.6	0.3	—	0.9	47.5
Scotland	9	0.8	13.4	3.5	—	—	17.7
Staffs., Shrops., Worcs., and Warwick ..	9	—	9.6	1.6	—	—	11.2
S. Wales and Monmouthshire	8	2.8	23.8	—	—	—	26.6
North-West Coast	8	16.6	—	0.2	—	1.0	17.8
Total ..	100	27.4	142.1	28.3	1.0	2.6	201.4[1]
March, 1952 ..	102	25.4	143.8	29.0	1.0	2.5	201.7
April, 1951 ..	99	25.9	122.7	24.6	1.9	3.4	178.5

[1] Five weeks, all tables.

[2] Weekly average of calendar month.

[3] Stocks at the end of the years and months shown.

[4] Other than for conversion into any form of finished steel listed above.

[5] Includes finished steel produced in the U.K. from imported ingots and semi-finished steel.

[6] i.e., Material for conversion into other products also listed above.

[7] Included with alloy steel.

Hot-dip Galvanizing Conference

The second international conference on hot-dip galvanizing was held in Düsseldorf from June 30 to July 4. For this occasion, use was made of the beautiful Landtag building (seat of the Provincial Parliament for the district of North Rhine and Westphalia), and this concession had been secured through the good offices of the official committee of German galvanizers. Some 12 countries sent representatives, including U.S.A., Great Britain, France, Holland, Norway, Sweden, Switzerland, and, of course, Austria and Germany. The conference was organized in collaboration with the Germany committee by the Zinc Development Association. A complete list of the papers was given in our issue of July 3, on page 28.

Galvanizing Cast Iron

MR. W. MONTGOMERY, introducing the single Paper devoted to the galvanizing of cast iron, said that he had tried to deal with the aspects of the galvanizing of castings which were of major interest to jobbing galvanizers. The technique depended on the quantity of work, but there was no doubt that abrasive blasting was of very great benefit where long runs were to be galvanized. Though some people had said that the presence of aluminium increased the difficulty of galvanizing castings, he had not found it so and would be glad to hear of others' experiences.

He had not said much about malleable iron, because it could be treated much like mild steel; he had concentrated on grey iron which was the most difficult to galvanize. He believed that nothing had previously been published about the galvanizing of nodular cast iron. He explained that this material was a true grey iron as originally cast, but that the graphite was rendered nodular by the addition of cerium or magnesium, which also removed sulphur. Since Morrogh's original British discovery using cerium, it had been found in America that the modification of the graphite could be more easily effected with magnesium, though there was still work to be done on the subject.

Cast iron offers problems to the galvanizer which are not encountered when steel is being processed. In order to appreciate the difficulties one must consider the fundamental differences in composition and microstructure between grey cast iron and mild steel of the composition generally used for hot-dip galvanizing.

Such considerations can be facilitated if cast iron is regarded as a very impure steel. It contains all the elements usually associated with steel, but in much higher proportions. Since galvanizing is essentially a surface reaction, it is obvious that the only microconstituents which can influence the rate of its progress are graphite, carbide and silico-ferrite. Of these, only graphite resists wetting by molten metals. From investigations carried out on silicon steels, the evidence suggests that silico-ferrite is likely to react more vigorously with zinc than pure ferrite. On the other hand, massive cementite can take part in surface reactions of an oxidation/reduction nature with surface oxide at galvanizing temperatures, liberating gaseous oxides of carbon.

The presence of surface graphite requires careful consideration. Malleable castings contain much graphite, but none of this is at the surface. In white-heart malleable iron there is a very definite decarburized zone at the edges, and this silico-ferrite layer gives no trouble in galvanizing. The absence of surface graphite allows the castings to be processed in a manner similar to steel. For samples of the new nodular cast iron, a microsection showed the surface to be free from graphite, an effect due to undercooling at the mould face. Together with some specimens of ordinary grey cast iron (of comparable analyses), samples were deliberately overpickled in 10 per cent. cold hydrochloric acid, washed, and prefluxed in hot No. 20 flux. On galvanizing, the nodular irons coated perfectly after an ordinary "boiling off," while the ordinary irons required a lengthy time in the bath (about 20 min.) in order to coat properly.

Conclusions

The Paper discusses at length the effects of C, S, Si, P, and Mn, and also surface treatment prior to galvanizing, the following being the conclusions reached:—

In spite of the many suggested methods for the treatment of grey-iron castings before hot-dip galvanizing, only two can be recommended as being of practical value to the general galvanizer. Shotblasting gives by far the best results; but it must be followed by a short dip in hydrochloric acid. The castings can then be immersed in the zinc through a suitable fluid flux cover and withdrawn through the clear metal. Excellent thin, smooth and even coatings are obtainable. A saving of 20 per cent. on the zinc pick-up has been obtained when using this method as against the traditional acid-pickling treatment on small production castings.

Where acid pickling is employed, it is wise to conduct the pickling operations in a liquor which has a rather high iron content or in one which contains a deliberate addition of an inhibitor. In this way excessive attacks of the acid on the iron surface is prevented and exposure of the graphite flakes obviated. After washing and fluxing, the castings may be immersed in small batches on suitable perforated trays which are conveniently submerged in the zinc. The methods which have been tried out so far to effect surface oxidation of the graphite are not suitable for general use.

Concluding his Paper, Mr. Montgomery said it was only a review and more fundamental work might be expected later from other authors. He expressed his thanks to the chairman and directors of Frederick Braby & Company, Limited, for allowing him to present his findings, and to Mr. W.

Walker for help in experiments with hydrofluoric-acid pickling.

Discussion

MR. C. P. H. WEDGE (B. E. Wedge, Limited) began the discussion by asking if Mr. Montgomery could confirm the figures a previous paper for the dross produced in the galvanizing of pipe-fittings. He added that he had seen a completely automatic plant for galvanizing malleable pipe-fittings in the United States and had been told that 50 per cent. dross was made. Did Mr. Montgomery believe that the quoted figure of 9.3 per cent. was a minimum?

MR. MONTGOMERY said that the figures referred to mass production, whereas his experience was limited to the galvanizing of occasional batches of castings. He had found that, when 120 ½-in. elbows were immersed for 80 sec. in baskets, the dross amounted to from 30 to 35 per cent.

DR. LOHBERG (Metallgesellschaft A.G.) said that he had no experience of galvanizing, but had made some experiments on the reaction between different cast irons and zinc die-casting alloys containing 4 per cent. aluminium. He showed a slide of photomicrographs in which it was seen that, when the graphite was present as flakes, the attack of zinc followed the flake boundary. However, when the carbon was spheroidal, the attack was quite regular.

MR. W. L. HALL (B.N.F.M.R.A.) referred to Mr. Montgomery's statement that, if care were taken not to break the skin of a casting in the preparation, galvanizing was easy. He thought that, if this fact were borne in mind and the use of nodular cast iron was more widespread, problems facing galvanizers of cast iron would be considerably reduced. He therefore asked Mr. Montgomery what fundamental research was yet to be done.

MR. E. MAYER referred to the mention in Mr. Montgomery' Paper of sodium hydride. He had tried it but found it quite unsuitable for castings, though it and salt-bath pickling had been found in the United States and elsewhere to be valuable with certain types of stainless steel.

Malleable Castings

MR. R. E. NUTT (Court Works Limited) commented on the Author's statement that certain embrittling effects were in evidence in malleable iron castings after galvanizing. He suggested that this was the the case in whiteheart malleable iron having a silicon content of 0.5 per cent. with phosphorus 0.05 per cent. His experience had been that tests over a long period of years tended to prove that galvanized test-bars in malleable cast iron gave results equal to those which had not been galvanized but only cast and annealed. He also suggested that lengthy annealing and slow cooling gave decreased tensile strength but greater elongation; he therefore considered that this could not cause embrittlement.

A future problem for galvanizing research would be the galvanizing of malleable iron castings which had been annealed by the gaseous process in an electrical furnace. These furnaces after a period of operation all seemed to reach a stage when air was drawn in from outside, thus causing oxidation and scaling in varying degrees. This scale could not be removed by shot-blasting or ordinary pickling and in the speaker's opinion demanded a special process.

MR. MONTGOMERY said that he was pleased to have provoked such an interesting discussion. He said that the specimen Mr. Nutt had produced was coated with a film of Fe_3O_4, which was very insoluble. It, in fact, resembled Bower-Barffing; he did not know any simple way of removing the film.

He had been interested to see Dr. Lohberg's slides and observed that the face of the castings containing spheroidal graphite was free from carbon. He added that his statement in the Paper was in accordance with Dr. Hughes' observations made earlier in the Conference. He agreed with Mr. Mayer that sodium-hydride pickling was out of the question for galvanizing. In conclusion he said that the British Cast Iron Research Association had carried out fundamental investigations on tinning and vitreous enamelling, so he thought there was no reason why they should not also investigate galvanizing.

Adding to Britain's Pig-iron Output

The 14th blast furnace to be completed by Ashmore, Benson, Pease & Company, of Stockton-on-Tees, since the war ended in 1945 was blown-in on July 1. It was the third furnace built by the firm to go into production within a period of 40 days. Capable of producing 700 tons of pig-iron per day, this furnace was, in fact, a reconstruction of a modern, but smaller furnace at Consett (Co. Durham). The earlier unit had been in operation from March, 1943, until September 1950, during which time it had produced over 1,250,000 tons of pig-iron. Early in the following year, A.B.P. engineers started to enlarge the hearth of this furnace to bring it into line with the later Consett furnaces, each of which has a 20-ft. dia. hearth and can produce 700 tons of iron daily. Features were introduced during the reconstruction which will enable this furnace to work eventually on the new high-top pressure principle. While the alterations were in progress the other two furnaces remained in operation.

Two days earlier the third A.B.P. blast furnace at Margam, South Wales, began to produce pig-iron for steelmaking; it was erected and put into production in under a year. With a hearth diameter of 25 ft. 9 in., this furnace is designed to produce up to 1,000 tons per day and is a twin to the No. 2 furnace, which went into production in 1950. These two units are the largest blast furnaces in operation in Britain. The third furnace to be commissioned recently was the No. 1 furnace at Cargo Fleet Ironworks, which has a daily capacity of over 600 tons. Ashmore, Benson designed this furnace and the construction was carried out conjointly with the Cargo Fleet Iron Company. From foundations to the commencement of production took one year and 10 months.

The 14 post-war furnaces for which this Stockton firm has been directly responsible are together capable of producing 9,000 tons of pig-iron per day. If to this is added the potential output of furnaces now under construction, the figure exceeds 12,000 tons. In addition, 3,000 tons per day of furnace capacity is being built in Western Europe by associates under licence.

Law for the Service Man

By F. J. Tebbutt

The Reserve & Auxiliary Forces (Protection of Civil Interests) Act, 1951—an agreed measure of all parties—is a permanent Act, which gives protection in respect of their civil liabilities to men and women of the Forces (Navy, Army, Air Force), covering practically all forms of service, officers and other ranks, except the Regular Forces. The Act has seven parts and three schedules.

Debts and Certain Legal Remedies

For debts, the Act provides that even though a court judgment or order has been obtained, a creditor cannot proceed to obtain payment or recovery of a sum of money, that is by execution, judgment summons, etc., unless permission of the court is obtained. That applies to cases where a Service person is concerned or members of a Serviceman's family; also to guarantors, etc., if their inability to meet their obligations is through the calling-up of a person for service. This section of the Act does not apply to County Court judgments; this Court already has power to protect debtors in the case of money judgments. A point to note is that this does not mean that a creditor cannot take action or exercise certain "self-help" remedies to get the money but the Court must consider the case, and give permission to proceed. The Court can refuse entirely to give leave, or can give leave subject to conditions. A protection order, if made, can remain in force (even after the Serviceman has returned) until the Court varies or discharges it. The "self-help" remedies which can ordinarily be used are such things as:—The levying of distress; the taking possession of any property; the appointment of a receiver; re-entry upon land; the realization of a security; or the forfeiture of a deposit. Proceedings for foreclosure or for the recovery of possession of mortgaged property cannot be instituted. All these now require "leave of the Court," and leave is also required for cases of default in the payment of rent.

If a creditor has executed a judgment or exercised a remedy against a Service person covered by this Act, or has done what is called a "snatch back" with regard to hire-purchase goods without "leave of the Court," he may have to pay damages for so doing, although if the court believes he has acted honestly and reasonably and should be excused, he may be exempted from any damages which otherwise might be awarded. Part II gives protection against eviction from a Serviceman's rented residence, if he has one or more dependants living on the premises.

Business and Professional Premises and Leases

Other provision applies to factories, shops, etc., but only if the duration of service is for three months or more, and only if the expiring date of a tenancy occurs while the tenant is serving or within two months thereafter. On application being made, the County Court can grant a lease (and decide rent and conditions), such lease not to run beyond four months after the end of the Service. The Serviceman must have been a "working proprietor" of a business or professional practice (partnerships and companies included), the object, it is stated, being to help the small man.

Parts IV, V, VI

By Part IV (which concerns superannuation schemes) public authorities and trustees of private pensions schemes in industry and commerce, for superannuation purposes, can treat the Service period as though it was a continuation of the person's ordinary occupation. All the Services are covered except National Servicemen,

Continued at the foot of Col. 2)

Book Reviews

Warne's Avoirdupois Weight Calculator and Ready Reckoner, Vol. 2. Published by Frederick Warne and Company, Limited, Chandos House, Bedford Court, Bedford Street, London, W.C.2. Price 15s. net.

A second volume of this well-known ready reckoner has been found necessary owing to inflation. The first one covered a range starting at a farthing and going up to 5s. This one starts at the latter and with the same increments goes up to 10s. per lb. To record this gargantuan task it needs 274 pages of tables! For mercantile offices the book should be invaluable.

Manufacturing Processes (Third Edition) by M. L. Begeman. Published by John Wiley & Sons, Inc., New York, and Chapman & Hall, Limited, 37, Essex Street, Strand, London. Price 48s. net.

An attempt has been made to impress within the covers of one book matter normally contained in about half a dozen text-books. The exercise of compression in technical literature, such as has been forced upon writers in this country during the last decade, has not been detrimental either to clarity of exposition or technical progress. This book of over 600 pages, divided into 23 chapters, covers the whole of the processes—except surface treatment—usually encountered in a large engineering works:—foundry, forge, heat-treatment, powder metallurgy, plastic moulding, welding, and a study of the major pieces of plant to be found in the machine-shop. Here then is exemplified the art of compression and the author, being well aware of this, rightly finished each chapter by a list of American references. These are preceded by a list of questions, while here and there the matters dealt with do suffer from being too drastically condensed, yet the author has made a commendably good job.

There seems to have been a mistake in both the caption of Fig. 2 and the reference to it. It is quite bewildering to read of and to gaze upon a "single strand core oven." Actually it is a conveyor that is meant. Again Fig. 13 shows two types of crucible furnaces and not "crucible furnace for non-ferrous metals." This, too, might be muddling to the student. The next comment is that on page 87, the author refers to cutting off wheels 20 in. diameter and ¼-in. thick! Considering that this is the third edition, such mistakes as we have listed should have had attention. The reviewer has limited his survey to the foundry and cognate sections, which is perhaps a little unfair, as this represents but a sixth of the book. The machine-shop part is probably excellent, but a reviewer skilled in this section of engineering would be unfamiliar with the other processes and therefore still give what must always be with such a book as this an unbalanced criticism.

V.C.F.

whose rights are already provided for by earlier Acts. Part V gives power to local authorities for the balance of civil pay to be paid to persons called up. Part VI, which applies to life policies in industrial assurance, collecting societies, etc., roughly provides that, if one year's premiums (or more) have been paid, policies may not be forfeited because of non-payment of premiums due to service in the Forces, and there must be reinstatement of any policies already forfeited, before the passing of this Act. It might be pertinent to add that, although ordinary (that is, not industrial assurance policies) policies are not covered by this 1951 Act, the insurance companies have stated that they will give sympathetic treatment to persons who have difficulty in meeting payment of premiums by reason of being called up.

New Steel Sales Company

The formation of a new company—R.T.S.C. Home Sales, Limited—has been announced jointly by Richard Thomas & Baldwins, Limited, and the Steel Company of Wales, Limited. The registered office of the company will be at 47, Park Street, London, W.1.

The company is being formed for the purpose of effecting and carrying through as principals (not as agents) sales in all parts of the United Kingdom and Northern Ireland, the Channel Islands, and the Isle of Man of the flat rolled steel products manufactured by Richard Thomas & Baldwins, Limited, and the Steel Company of Wales, Limited. The capital of the company to start with will be £10,000, divided into 10,000 shares of £1 each, £5,000 being subscribed by Richard Thomas & Baldwins and £5,000 by the Steel Company of Wales.

The first directors of the company will be Mr. H. F. Spencer, assistant managing director of Richard Thomas & Baldwins, and Mr. E. Julian Pode, managing director of the Steel Company of Wales, who are directors of R.T.S.C. Exports Limited, which was formed a year ago to co-ordinate and stimulate sales of these products throughout the world.

The company will not become active until near the end of this year or early in 1953, and customers are being requested to continue their present contracts with the individual companies until advised to the contrary.

French Iron and Steel Production

Production of pig-iron in France was 849,000 metric tons in May against 788,000 metric tons in April. Saar pig-iron output in May was 233,000 metric tons, compared with 202,000 metric tons in the previous month. Crude steel output in France was 937,000 metric tons in May, against 910,000 metric tons in April. Saar crude steel production was 241,000 metric tons, compared with 218,000 metric tons in the previous month.

French output of rolled steel products was 665,000 metric tons in May, against 655,000 metric tons in April. Saar output of rolled products was 161,000 metric tons, compared with 151,000 metric tons in the previous month. The increase in French steel output is attributed to improved coke supplies.

West German Iron and Steel Production

Production of pig-iron in Western Germany in June was 1,015,168 metric tons, a decrease of 56,951 tons from the level reached in May. Average production per working day declined to 33,839 metric tons from 34,584 tons in the previous month.

Crude steel production totalled 1,224,156 metric tons, a decrease of 64,878 tons from the May production figure. Average production per working day rose by 392 tons to 49,970 tons. Output of rolled-steel products was 799,080 metric tons, against 869,731 tons in the previous month.

The decline in production is attributed to the smaller number of working days in June and the influence of works' holidays.

THE UNITED STATES DEFENCE DEPARTMENT has accepted a bid of $1,137,605 (£406,300) made by Ferranti Electric Inc., a subsidiary of Ferranti, Limited, for electrical equipment from Britain for a dam project in North Dakota. The contract is for nine 33,333 k.v.a. power transformers and spare parts.

Iron and Steel Distribution Scheme Changes

A number of technical changes in the iron and steel distribution scheme took effect on Monday.

The changes include:—(*a*) Large springs have been taken off the directly controlled list. Manufacturers incorporating springs in their products now have to give springmakers a sub-authorization out of their main allocation; (*b*) the amount of electrical conduit which can be obtained without permit under the small quantities exemptions has been reduced to 3 cwt. a month.

Relaxations have also been made in the special arrangements for economizing in the use of alloy steels containing nickel and molybdenum. The direction to steelmakers has been amended to add the following to the list of special-purpose steels not subject to restrictions:—(*a*) Induction-hardening steels; (*b*) any gun component steel to Ministry of Supply Specification S56 or to Admiralty Specification E52, E53, or E54; (*c*) any steel to any Ministry of Supply I.F.V. Specification or to any Admiralty Specification being (in each case) a specification containing a ballistic test standard; (*d*) armour-piercing projectile steels, torpedo steels; (*e*) turbine-blading steels; and (*f*) steels prepared as a drawn wire in coil. These may now be used without permission from the Ministry of Supply's Director of Alloy Steel Control.

The changes are made by the Iron and Steel Distribution (Amendment No. 2) Order, 1952 (Stationery Office, price 2d.). A revised edition of "Notes for Consumers" will be available very shortly.

Need for Wage Restraint

Wages increases apart, we could hope for stable or falling prices for about 60 per cent. of the goods and services we bought or used—that was for everything other than food, said the Chancellor of the Exchequer, Mr. R. A. Butler, in Exeter recently. From October, 1950, to May, 1952, he said, wage rates rose by 16 per cent., estimated earnings by about the same, and prices by 17 per cent. This did not make a strong case for appreciable wage increases. Any considerable rise in wages in the engineering industry would bring about a loss of many existing export markets, not to speak of any hope of increasing engineering exports. A rise of £1 a week for all workers would put up export prices by about 1s. 2d. in the pound, he said. This reckoned only the direct effect of the rise, and was by no means the whole story. A damaging blow would be struck at large parts of the export trade.

Every £1 a week rise in the miners' wages, explained the Chancellor, meant that the pithead price of coal went up by 3s. 6d. a ton. If in addition to this rise in coal prices the pay of railway workers rose by £1 a week, passenger fares and charges would have to rise by 8 per cent. If 10,000,000 workers had an average wage rise of £1 a week, the cost of living would rise by about 2s. 4d. a head a week, or 9s. 4d. a week for a family of four.

The recent downward movement in the prices of raw materials, he affirmed, should mean that we were certain of fairly stable retail prices for manufactured goods for several months.

A PARTY of 300 Uppingham schoolboys visited Sheffield recently, and in small parties toured 16 local works. They were afterwards entertained to tea at the Cutlers' Hall by the Master Cutler, Mr. Geoffrey M. Flather.

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News in Brief

TRUST PRODUCTS, LIMITED, Sheffield, have recently acquired the agency in this country for "Bauknecht" high-frequency furnaces.

A SURVEY of economic and commercial conditions in Peru was published by Her Majesty's Stationery Office last week, price 3s. 6d. (post free 3s. 8½d.).

THE TELEPHONE NUMBER of the Penton Publishing Company, Limited, 2, Caxton Street, London, S.W.1 (Mr. V. Delport, managing director), has been changed to Abbey 2796/7.

ALTHOUGH the profits for the six months to June 30, 1952, are affected by the general recession in trade, the directors of Blythe Colour Works, Limited, have maintained the interim dividend at 12½ per cent.

THE 1951-52 annual report of the British Welding Research Association contains a review of the research progress of the metallurgical, engineering and resistance welding committees. It is available to our readers by writing to their offices at 29, Park Crescent, London, W.1.

AN OUTBREAK OF FIRE in a shed at the works of H. Downs & Sons, ironfounders, St. Andrew's Road, Huddersfield, on July 16, caused damage to wooden patterns estimated at £200, while some slight damage was done to the structure of the shed. Arrangements have been made to carry on business as usual.

IN THE ARTICLE on page 32 of the JOURNAL, July 10 issue, entitled "Applications of Synthetic Resins," where reference was made to a finely-powdered resin for use with the shell-moulding process, this should relate to a P.F. type of resin and not U.F. as printed. Apologies are tendered to all who may have been misled.

A COSELEY FOUNDRY, which wishes to remain anonymous, has made an offer to Coseley Urban Council to purchase all the necessary equipment for a playground for children in a new housing estate in the area, giving as reason, "because we made our money in this area we feel we should do something in return for the people."

MR. J. HENDERSON STEWART, joint Under-Secretary of State for Scotland, during a debate on Scottish industry in the House of Commons recently, said that blast-furnaces at the Clyde Iron Works would be improved and extended, and a fourth furnace, for which equipment was now on order, would cost £2,500,000 and would be the biggest in the United Kingdom.

THIS YEAR, at the Royal Show held at Newton Abbot, there was a special display under the general heading of "Devon Engineers Report Progress" and amongst those exhibiting in this section was the firm of Garton & King, Limited, of Exeter Foundry, Exeter—a firm established in 1661. Included in this exhibit was a display of some of the items in the history of the firm, including the "Sign of the Golden Hammer," which attracted much interest. This, we gather, hangs outside the entrance to the works.

A THIRD of the foundry workers at the Royal Naval Torpedo Works at Alexandria, Dumbartonshire, have been given notice. Union officials at the factory were told this by Capt. Coventry, C.B.E., who is in charge of the establishment. Shortage of work and no immediate programme in hand was given as the reason. About 16 men are affected, but as this department acts as a feeder for the whole factory, further dismissals would appear imminent. About 1,200 are employed at Alexandria, including about 300 who travel from Greenock.

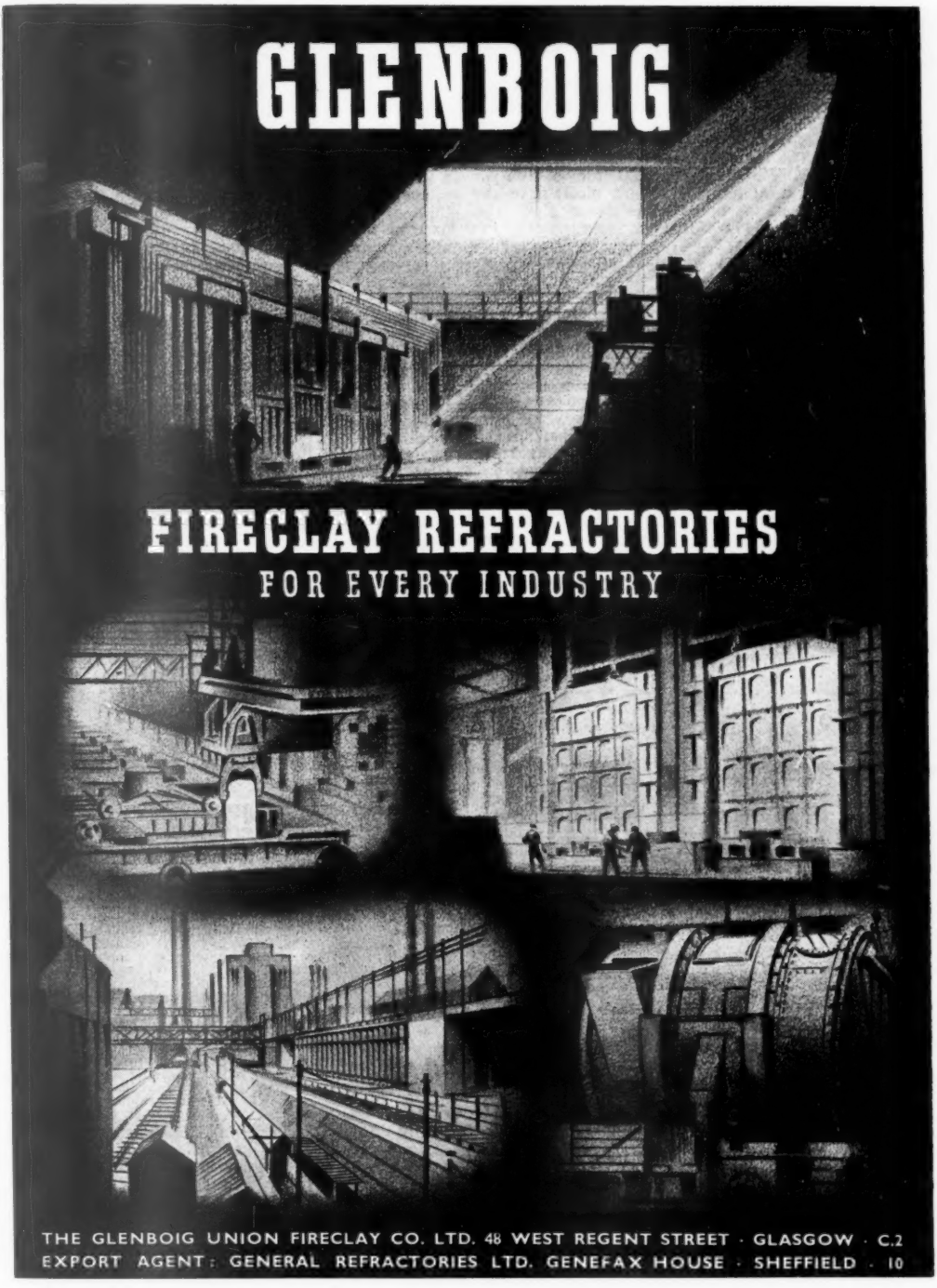
NEWMAINS FOUNDRY and engineering works of Coltness Holdings, Limited (Formerly Coltness Iron Company, Limited) are to be closed down within the next six months, and the employees (who number more than 400) have accordingly been informed by the management. The works, comprising a steel foundry, iron foundry and engineering shops, formed a servicing department for the company's collieries until these were taken over on nationalization in 1947. The plant and equipment, a spokesman of the firm said, are not suitable to compete with general engineering firms in open markets today.

A MEETING of Alex. Mathieson & Sons, Limited, old-established Glasgow light engineers and tool-makers, will be held on July 25 to consider the winding-up of the company. The business was founded 160 years ago and had connections in many overseas markets, the normal employee roll being about 200. Recently, however, demand has fallen off, the cut in Australian imports being a contributory cause, and only "key" men remain at the East Campbell Street works. It is understood that an offer has been made for the shares, but whether any sale would mean continued production remains to be seen.

A SCOTTISH TRADE AND INDUSTRIES EXHIBITION is being planned by the Scottish Council (Development and Industry) for 1954 in Glasgow, on the same scale as that of 1949, and with an international appeal. It is stressed that it will be a "selling" exhibition, particularly aimed at the American market. Mr. A. B. King, convener of the Publicity Committee, said that an application has been submitted for space in the Kelvin Hall. The objects of the exhibition will be to make the increasing range of Scottish products better known to overseas buyers. The 1949 exhibition, in which over 300 firms took part, brought £10,000,000 in orders, apart from the business that later accrued.

THE MINISTRY OF SUPPLY is to help between 200 and 300 selected Midland engineering firms to increase their exports. This was disclosed by Mr. F. C. Limbrey, deputy regional controller, after a meeting in Birmingham on July 15 of the Midland Regional Board of Industry. He stated that the Ministry had aimed at selecting firms where the quickest results in overseas markets could be expected, and Mr. Limbrey added that the Ministry hopes to ensure that the selected firms meet no obstructions in obtaining their steel and non-ferrous metal allocations. Furthermore, the Ministry proposes to oversee their applications for building extensions. The scheme, he said, is to be operated in collaboration with the Board of Trade. Essential needs at home would be borne in mind as well as the continuing demand overseas for our engineering products.

BY A MAJORITY of six, a jury sitting with Lord Birnam in the Court of Session on July 9 awarded £600 damages to Thomas McGauley, moulder, who lives at Barrhead, in an action in which he sued Saunders & Connor (Barrhead), Limited, Darnley Works, Barrhead, his employers, for £1,500. On February 7, 1950, the pursuer lost part of his left index finger as a result of an accident when he was casting flushing cisterns at defenders' foundry. The operation involved moving casting boxes on skid rails, and he contended that, because the sections of the rails were not flush, a section of one of the boxes slipped and his finger was caught between it and the rail. Defenders, he said, failed to maintain a safe system with regard to the alignment of the rails. The defendants denied liability and maintained that the accident was caused by pursuer's own fault in not taking normal precautions for his safety when lowering the section of the box on to the rails.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Raw Material Markets

Iron and Steel

The blowing-in of a new blast furnace at Margam for the production of basic pig-iron will bring much-needed help to the steelworks in South Wales, where the scarcity of raw materials is a severe handicap to production. The furnace, one of the largest in the country, is capable of producing 1,000 tons of iron per day. With the three furnaces recently blown-in on the North-East Coast, the potential output of pig-iron is nearing the target of 11,000,000 tons per year.

While the new furnaces will mainly provide supplies of steelmaking pig-iron, the prospect of larger tonnages of pig-iron being made available for the foundries is brighter and will, it is hoped, avoid the necessity of changing over furnaces now producing foundry irons to the basic grades. There is, however, pressure by the steelworks for pig-iron to fill the gap in supplies of raw materials brought about by the scrap shortage.

Most foundries are anxious to acquire increased quantities of pig-iron. Fortunately, resumption of work following a strike at one of the producers of the low- and medium-phosphorus irons has enabled that furnace to recommence deliveries in time to avoid serious repercussions at the engineering and speciality foundries, which are seeking far more of these grades of pig-iron than the present level of production can supply. In addition, they are using all available supplies of hematite and refined irons, both of which are stringent, barely sufficient tonnage being available to meet urgent demands.

These foundries are well provided with work, while most of the jobbing and light foundries continue to be well employed. The supply of high-phosphorus pig-iron is not sufficient to meet all requirements of the trade, although the furnaces recently blown-in on this grade have eased the position slightly.

Shortage of the heavy and better grades of scrap is unrelieved, but improved supplies of light scrap are available. Foundry coke is sufficient to meet current consumption, but there are still no additional supplies with which to augment stocks.

Many of the re-rollers have benefited by consignments of steel from abroad, but sufficient quantities are not being received to guarantee full-time working, and there is little prospect of increased tonnages being received from home steelworks. There is little, if any, improvement in demands from oversea buyers, but orders are on hand for the colonies and against bilateral trade agreements, which, coupled with requirements for home users and stockists, are sufficient to keep the mills fully employed if sufficient supplies of steel semis could be obtained.

Sheets are in heavy demand and re-rollers have plenty of orders for both black and galvanized sheets, which call for increased supplies of sheet bars and slabs. All arisings of defectives, crops, etc., are readily absorbed, but supplies remain scarce.

Non-ferrous Metals

Last week saw the publication of the schedule of amended maximum prices for secondary copper and brass and also for scrap. Increases were along the lines anticipated, *viz.*, the full £6 advance in secondary copper and the relative proportion in brass. In scrap, the upward adjustment was made, as is customary, on the basis of 90 per cent. of the rise in the virgin metal, this method operating for brass as well as copper, cupro nickel, gilding metal, etc. The operation of adjusting secondary metal and scrap quotations is a protracted one and the trade would be greatly relieved were the Ministry of Supply to find it possible to change its maximum prices with as much celerity as the Ministry of Materials does its quotations for virgin metals. The present arrangement is certainly not satisfactory, for, following a rise in the virgin copper price, the period of waiting for the revised scrap maximum rates to be established is one in which business in secondary metals comes almost to a standstill.

The trade has been cheered to learn that for the third quarter the U.K. allocation of copper has been fixed by the I.M.C. at 100,300 metric tons, an advance of 3,100 tons on the second quarter. Nickel allocations, too, have been raised somewhat, the United Kingdom's share being 5,428 tons. There are now some hopes that the fourth quarter of the year may be free of allocation for copper. This seems possible for U.K. stocks are pretty favourable and June 30 saw a substantial improvement in the world position of stocks.

In Britain it would appear that there is some falling off in demand for copper in connection with rolled metal, although the call for H.C. wire and copper tubes is still high. Broadly speaking, the inflated price of the metal has not so far operated to check demand, but it must be expected that in due course high cost will act as a brake on usage. It has been reported that negotiations between Bolivia and the Reconstruction Finance Corporation for a tin contract have been reopened, but Bolivia has no chance of selling her tin over the established price of 121¼ cents per lb. New York.

London Metal Exchange official tin prices were:—

Cash—Thursday, £972 to £972 10s.; Friday, £968 to £969; Monday, £965 to £966; Tuesday, £965 10s. to £966; Wednesday, £965 10s. to £966.

Three Months—Thursday, £970 to £970 10s.; Friday, £966 to £966 10s.; Monday, £964 to £964 10s.; Tuesday, £963 10s. to £964; Wednesday, £964 to £964 10s.

Non-ferrous Scrap Metal Prices Increased

Increased prices for secondary copper, brass, copper scrap, gilding metal scrap, brass scrap, and cupro-nickel scrap came into operation on July 16. They take account of the recent increase in the selling price of virgin copper. The revised prices are contained in the Copper, Zinc, etc., Prices (No. 3) Order, 1952 (SI No. 1317) made by the Minister of Supply.

The new prices (per long ton) are:—

SECONDARY COPPER (increased by £6):—Ingot bars or wire bars: (*a*) Electrolytic, £285 10s.; (*b*) fire refined, (1) equivalent to HC, £285 10s.; (2) minimum 99.88% copper, £285; (3) minimum 99.70% copper, £284 10s.; (4) minimum 99.50% copper, £284; (*c*) other than (*a*) or (*b*) above, £245; cathodes, £284 10s.; other, £245.

BRASS (increased by £3):—(1) To BSS No. 218 or No. 249: (*a*) Cropped billets, £233; (*b*) uncropped billets, £231; (*c*) ingot, £228; (*d*) other than (*a*) to (*c*), £228; (2) 65/35 casting quality: Ingot, £232; other than ingot, £232; (3) 70/30 casting quality (minimum 68% copper): Ingot, £242; other than ingot, £242; (4) 63/37 strip ingot for rolling, £242; (5) 70/30 strip ingot for rolling, £253; other than (1) to (5) above, in proportion.

COPPER SCRAP (increased by £5):—Clean, bright, untinned or tinned wire, commutator bar, £255; firebox cut to crucible size, £255; firebox not cut, £250; No. 1 wire, £245; clean heavy, £240; No. 2 wire, £235; braziery, £213; other, in proportion.

CUPRO NICKEL SCRAP:—70/30 Process scrap, £282 (up by £3); 70/30 used condenser tubes, £242 (up by £3); 80/20 process scrap, £265 (up by £4); other, in proportion.

GILDING METAL SCRAP (increased by £4):—In any form, £240.

BRASS SCRAP (increased by £3):—QF cases free from primers, £215; QF cases not free from primers, £209; SAA cases mechanically treated or fired, £205; SAA cases muffled or furnaced, £199; cuttings, £202; rod and fuze scrap not burned, £187; swarf, £177; heavy, £172; other, in proportion.

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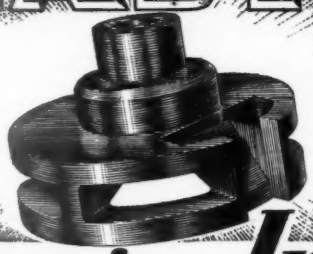

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Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered, unless otherwise stated)

July 23, 1952

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £13 1s. 6d.; Birmingham, £12 15s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £13 17s. 6d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent P, up to 3 per cent. S), d/d within 60 miles of Stafford, £15 5s. 9d.

Scotch Iron.—No. 3 foundry, £14 4s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £17 4s. 6d.; South Zone, £17 7s.

Refined Malleable.—P, 0.10 per cent. max.—North Zone £17 14s. 6d.; South Zone, £17 17s.

Cold Blast.—South Staffs, £18 7s.

Hematite.—Si up to 2½ per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. Coast and N.-W. Coast of England, £13 11s. 6d.; Scotland (Scotch iron), £13 18s.; Sheffield, £14 9s. 6d.; Birmingham, £14 17s. 6d.; Wales (Welsh iron), £13 18s.

Basic Pig-iron.—£12 10s. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered.)

Ferro-silicon (6-ton lots).—40/55 per cent., £57 10s., basis 45% Si, scale 21s. 6d. per unit; 70/84 per cent., £86, basis 75% Si, scale 23s. per unit.

Ferro-vanadium.—50/60 per cent., 20s. 6d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 10s. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £204; ditto, copper-free, £212.

Ferro-tungsten.—80/85 per cent., 29s. 9d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 32s. 9d. per lb. of W.

Ferro-chrome (6-ton lots).—4/6 per cent. C, £85 4s., basis 60% Cr, scale 28s. 3d. per unit; 6/8 per cent. C, £80 17s., basis 60% Cr, scale 26s. 9d. per unit; max. 2 per cent. C, 2s. per lb. Cr; max. 1 per cent. C, 2s. 2½d. per lb. Cr; max. 0.15 per cent. C, 2s. 3½d. per lb. Cr; max. 0.10 per cent. C, 2s. 3¾d. per lb. Cr.: max. 0.06 per cent. C, 2s. 4d. per lb. Cr.

Cobalt.—98/99 per cent., 20s. per lb.

Metallic Chromium.—98/99 per cent., 6s. 5d. to 6s. 9d. per lb.

Ferro-manganese (blast-furnace). — 78 per cent., £43 15s. 2d.

Metallic Manganese.—93/95 per cent., carbon-free, £262 per ton.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £25 4s. 6d.; tested, 0.08 to 0.25 per cent. C (100-ton lots), £25 14s. 6d.; hard (0.42 to 0.60 per cent. C), £27 12s.; silico-manganese, £33 8s.; free-cutting, £28 8s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £31 9s.; case-hardening, £31 17s.; silico-manganese, £34 9s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £29 8s.; basic, hard, over 0.41 up to 0.60 per cent. C, £30 8s.; acid, up to 0.25 per cent. C, £31 17s.

Sheet and Tinplate Bars.—£25 3s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £29 14s.; boiler plates (N.-E. Coast), £31 1s. 6d.; chequer plates (N.-E. Coast), £31 3s.; heavy joists, sections, and bars (angle basis), N.-E. Coast, £27 17s.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested, £31 15s. 6d.; flats, 5 in. wide and under, £31 15s. 6d.; hoop and strip, £32 10s. 6d.; black sheets, 17/20 g., £40 12s. 6d.; galvanized corrugated sheets, 17/20 g., £54 4s.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £50 18s. 3d.; nickel-chrome, £71 6s. 9d.; nickel-chrome-molybdenum, £78 14s.

Tinplates.—57s. 1½d. per basis box.

NON-FERROUS METALS

Copper.—Electrolytic, £287; high-grade fire-refined, £286 10s.; fire-refined of not less than 99.7 per cent., £286; ditto, 99.2 per cent., £285 10s.; black hot-rolled wire rods, £296 12s. 6d.

Tin.—Cash, £965 10s. to £966; three months, £964 to £964 10s.; settlement, £965 10s.

Zinc.—G.O.B. (foreign) (duty paid), £130; ditto (domestic), £130; "Prime Western," £130; electrolytic, £134; not less than 99.99 per cent., £136.

Lead.—Good soft pig-lead (foreign) (duty paid), £131; ditto (Empire and domestic), £131; "English," £132 10s.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £150 15s.; rolled zinc (boiler plates), all English destinations, £148 15s.; zinc oxide (Red Seal), d/d buyers' premises, £151.

Other Metals.—Aluminium, ingots, £157; magnesium, ingots, 2s. 10½d. per lb.; antimony, English, 99 per cent., £225; quicksilver, ex warehouse, £65; nickel, £454.

Brass.—Solid-drawn tubes, 27⅝d. per lb.; rods, drawn, 37⅝d.; sheets to 10 w.g., 31⅞d.; wire, 33½d.; rolled metal, 30½d.

Copper Tubes, etc.—Solid-drawn tubes, 32⅝d. per lb.; wire, 320s. per cwt. basis; 20 s.w.g., 348s. 6d. per cwt.

Gunmetal.—Ingots to BS. 1400—LG2—1 (85/5/5/5), £220 to £270; BS. 1400—LG3—1 (86/7/5/2), £245 to £280; BS. 1400—G1—1 (88/10/2), £352 to £400; Admiralty GM (88/10/2), virgin quality, £375 to £380 per ton, delivered.

Phosphor-bronze Ingots.—P.Bl, £365 to £425; L.P.Bl, £300 to £335 per ton.

Phosphor Bronze.—Strip, 44½d. per lb.; sheets to 10 w.g., 46½d.; wire, 49½d.; rods, 45d.; tubes, 43½d.; chill cast bars: solids 4s. 5d., cored 4s. 6d. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 2s. 9½d. per lb. (7%) to 3s. 10½d. (30%); rolled metal, 3 in. to 9 in. wide × .056, 3s. 3½d. (7%) to 4s. 4½d. (30%); to 12 in. wide × .056, 3s. 4d. to 4s. 4½d.; to 25 in. wide × .056, 3s. 6d. to 4s. 6½d. Spoon and fork metal, unsheared, 3s. 0½d. to 4s. 1½d. Wire, 10g., in coils, 3s. 10½d. (10%) to 4s. 10½d. (30%). Special quality turning rod, 10%, 3s. 9½d.; 15%, 4s. 2½d.; 18%, 4s. 6½d. All prices are net.

Obituary

MR. HARRY ARCHER ANDREWS, who has died at the age of 75, was chairman of Andrews & Platt (Engineers), Limited, Leeds.

MR. WILLIAM SHEARER, chairman of Balfour, Beatty & Company, Limited, electrical engineering contractors, etc., of London, E.C.4, died on July 16. Born in Scotland in 1881, he joined Balfour, Beatty & Company in 1909 and devoted much of his time to the finance of electrical power companies.

MR. WILLIAM FAIRWEATHER, O.B.E., who has died at Dunning, Perthshire, in his 80th year, served his apprenticeship as a moulder at Forfar Foundry and in 1898 went to Pietermaritzburg, South Africa. A few years later he returned home, but in 1903 went to Bombay and became assistant manager in the Great India Peninsular Railway workshops at Parel. He was foundry superintendent with the Angus Engineering Works, Calcutta, from 1922 until his retirement in 1931.

According to the *Engineer and Foundryman* (South Africa), cast-iron briquettes, which contain additional carbon, have now been brought on to the South African market by the Metal Briquetting concern. They announce that they can produce these briquettes to contain any desired amount of the carbon, to the order of the foundryman. Their custom is to collect shavings and swarf from foundries, and to supply an equivalent weight of briquettes in return, but the company is now in a position to accept limited orders for the outright sale of briquettes.

Board Changes

LIGHTALLOYS, LIMITED—Mr. K. C. T. Marshall has been appointed a director.

NORMALAIR, LIMITED—Mr. W. M. Widgery has been appointed technical director.

WARD & GOLDSTONE, LIMITED—Mr. E. C. Sunderland has been elected a director.

PARSONS ENGINEERING COMPANY, LIMITED—Major R. C. William Neale has been appointed a director.

BRITISH VACUUM CLEANER & ENGINEERING COMPANY, LIMITED—Mr. J. J. Hambidge, joint managing director, has been appointed chairman in succession to Mr. H. C. Booth, who has retired.

SCOTTISH AGRICULTURAL INDUSTRIES, LIMITED—Mr. W. Douglas Kidd, manager of the Dundee branch, has been appointed to the board. He succeeds Mr. J. M. Fairlie, who has retired after 42 years' service.

BRITANNIC ELECTRIC CABLE & CONSTRUCTION COMPANY, LIMITED—Mr. H. W. Bowen has been appointed managing director. He recently resigned from his position of managing director of E.M.I. Factories, Limited.

VOKES, LIMITED—Mr. John Fearn has been elected to the board. Mr. Fearn is chairman of J. H. Shand, Limited, and is also a director of Westland Aircraft, Limited, Normalair, Limited, and Westland Engineers, Limited.

SANDERSON BROS. & NEWBOULD, LIMITED—Mr. J. R. A. Bull, who is managing director of the South African subsidiary company, Sanderson Newbould S.A. (Pty.), Limited, Johannesburg, has been appointed managing director of the parent company. Mr. H. T. Wordsworth has relinquished his appointment as general manager owing to health reasons, but remains a director.

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CLASSIFIED ADVERTISEMENTS

PREPAID RATES: Twenty words for 5s. (minimum charge) and 2d. per word thereafter. Box Numbers, 2s. extra (including postage of replies).

Advertisements (accompanied by a remittance) and replies to Box Numbers should be addressed to the Advertisement Manager, Foundry Trade Journal, 49, Wellington Street, London, W.C.2. If received by first post Tuesday advertisements can normally be accommodated in the following Thursday's issue.

SITUATIONS WANTED

QUALIFIED FOUNDRYMAN (39), iron, steel and non-ferrous, familiar latest techniques; moulding, method and quality control, wishes to contact progressive company.—Box 1952, FOUNDRY TRADE JOURNAL.

ASSISTANT FOUNDRY MANAGER (40), A.I.M., seeks more responsible position. All round technical and practical knowledge, iron and steel. Economic outlook.—Box 1951, FOUNDRY TRADE JOURNAL.

YOUNG MAN (27) seeks progressive position (preferably in London area) requiring initiative and ability. Grammar school education, 1st class City and Guilds foundry practice and science, pattern-making apprenticeship.—Box 1933, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER (45), A.M.I.B.F. Fully and semi-mechanised plants, light engineering (5 cwt.). Cupola, sand, patternshop control. Sandslingers, grey iron and non-ferrous. Gravity die. Keen, active. Progressive outlook. Housing accommodation essential. Services available now.—Box 1921, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER (46), M.I.B.F., A.M.I.P.E., desires to join small Midland Foundry requiring development and expansion. Thoroughly practical man, highly technically trained, fully conversant all modern methods, accustomed to sole and entire charge all departments; sales, commercial, excellent contacts. Can get substantial business and obtain economic production light castings. Specialist auto, engineering, electrical and allied trades, grey irons, high duty, malleable and non-ferrous. Experience lifetime in trade. Excellent record and references supplied. Willing to prove ability on salary/results turnover basis. Principals only.—Box 1927, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN (45), M.I.B.F., accustomed to full charge all departments, wishes final change to Midland (small) foundry, where ability to obtain results will be appreciated. Practical man, technically trained, wide knowledge specialist production, and full general knowledge of trade (30 years). Grey iron, high duty, malleable (whiteheart), non-ferrous, etc. Salary/results basis. Interested principals only.—Box 1928, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order 1952

ASSISTANT MANAGER (30-35) required. Practical and technical experience high duty iron, metallurgically trained. Jobbing Foundry, West London area.—Box 1922, FOUNDRY TRADE JOURNAL.

SMALL Foundry (North Midlands), making Rainwater and Soil Goods, require MANAGER, who must be fully experienced in the production of this class of castings.—Box 1948, FOUNDRY TRADE JOURNAL.

SENIOR SALES REPRESENTATIVE required for Midlands to represent Light Alloy Foundry. Successful applicant would be required to reside in Birmingham area; should preferably have a good knowledge of light alloy castings; previous sales experience with high level contacts essential; age 35/40. Attractive salary and prospects for the right man.—Reply, in confidence, stating previous experience and salary required, to MANAGING DIRECTOR, Box 1949, FOUNDRY TRADE JOURNAL.

SKILLED PATTERNMAKERS required for small- and medium-size pattern work. Good working conditions. Top rates paid. Canteen facilities.—SLOUGH FOUNDRIES LIMITED, Buckingham Avenue, Slough.

ASSISTANT FOUNDRY MANAGER required for Ironfounders in Glasgow, chiefly making cast iron flanged piping. Good disciplinarian. Give full details of experience and technical qualifications, with exact nature of present situation. State also age and salary expected.—Box 1919, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN wanted for foundry near Smethwick, Staffs., aged between 30 and 40. Preferably used to high duty irons but must possess drive and energy and the ability to get things done. This is a permanent progressive post for the right man. Applicants should state in confidence their complete experience together with salary required. —Box 1940, FOUNDRY TRADE JOURNAL.

METALLURGIST, with sound laboratory experience for Iron Foundry. Must have general knowledge of cupola and sand control. Salary offered will be according to experience.—Apply in first instance by letter, giving full details, to IAN ROSS (CASTINGS), LTD., 160, Bestobell Road, Trading Estate, Slough, Bucks.

METHODS ENGINEER required for Steel Foundry (making light and medium castings in Carbon and Alloy Steels). Knowledge of process planning an advantage. Please apply, giving full details of past experience, to The Secretary, BROWN, LENOX & COMPANY, LIMITED, Pontypridd, Glam., and state salary required.

HAYWARD-TYLER & CO., LTD., have a vacancy in their Non-ferrous Foundry for a FOREMAN, with sound practical experience of floor, bench and machine moulding and coremaking on jobbing and batch production of simple and intricate pressure castings. The successful candidate will be expected to take charge of the day-to-day operations, including melting in oil-fired furnaces under the direction of the Foundry Manager. The salary, including bonus, will be approximately £650 p.a.—Candidates should apply in writing to THE SECRETARY, Crawley Green Road, Luton, giving details of their qualifications, age, and experience.

REPRESENTATIVE, age about 30 years, wanted by well-known Core Compound and Foundry Equipment Manufacturers. Must have Foundry or Laboratory experience. Permanent position for suitable man. Applications treated in confidence.—Box 1920, FOUNDRY TRADE JOURNAL.

WANTED, SENIOR DRAUGHTSMAN for mechanical work on large Foundry project in Monmouthshire. Good salary, 5-day week, canteen, etc.—Apply, giving full details of experience, etc., to Labour Manager, GUEST KEEN & NETTLEFOLDS (CWMBRAN) LIMITED, Cwmbran, Mon., through Ministry of Labour, Pontnewydd, Mon.

ASSISTANT TO CHIEF METALLURGIST required by well-known Midland Malleable Ironfounders.—Apply, stating age, experience and salary required. Box 1945, FOUNDRY TRADE JOURNAL.

HAYWARD-TYLER & CO., LTD., have a vacancy in their Iron Foundry for a FOREMAN, with sound practical experience of foundry work. The successful applicant will be required to supervise various kinds of moulding, including green sand, floor and machine moulding. The salary, including bonus, will be approximately £650 p.a.—Candidates should apply in writing to THE SECRETARY, Crawley Green Road, Luton, giving details of their qualifications, age, and experience.

YOUNG Man required to take charge of small Mechanised Light Castings Foundry in West Midlands. Give full details of age, experience, and salary required.—Box 1944, FOUNDRY TRADE JOURNAL.

REPRESENTATIVES required, on commission basis, by Non-ferrous Founders and Pattern Makers. Men engaged in closely-allied products not objected to.—Write Box 1891, FOUNDRY TRADE JOURNAL.

REQUIRED.—DRAUGHTSMEN, with experience of gravity diecastings.—JOHN DALE, LTD., London Colney, St. Albans, Herts. Bowmansgreen 2266.

CHEMIST OR METALLURGIST with knowledge of chemistry and physics required for sand control in Cylinder Foundry (Midlands). Up-to-date laboratory existing. Staff Pension Scheme operating. State age, experience and salary required. Box 1893, FOUNDRY TRADE JOURNAL.

A COMPANY in Warwickshire, manufacturing domestic appliances, urgently requires the services of a FOUNDRY MANAGER. The plant produces castings, both on the floor and on the mechanised plant, for vitreous enamelling within the same works. The successful applicant will be required to take complete control of the foundry, and must be a man of high qualifications and ability. A high salary will be paid and the position is pensionable.—Replies in confidence to Box 714, DORLAND ADVERTISING, LTD., 18/20, Regent Street, London, S.W.1.